9

REPORT RESUMES

ED 010 651 64

INSTRUCTIONAL MEDIA AND CREATIVITY, (REPORT ON THE TORREY PINES CONFERENCE (AUGUST 31-SEPTEMBER 3, 1965).

BY- TAYLOR, CALVIN W. WILLIAMS, FRANK E.
UTAH UNIV., SALT LAKE CITY

REPORT NUMBER NDEA-VIIB-501 PUB DATE OCT 65
REPORT NUMBER BR-5-1018
CONTRACT OEC-5-16-001
EDRS PRICE MF-$0.90 HC-$23.72 593P.

DESCRIPTORS- CONFERENCES, *CREATIVITY RESEARCH, AUDIOVISUAL INSTRUCTION, *AUDIOVISUAL AIDS, *CLASSROOM MATERIALS, EDUCATIONAL RESOURCES, *MEDIA RESEARCH, INFORMATION DISSEMINATION, MEDIA SPECIALISTS, *CLASSROOM TECHNIQUES, LA JOLLA, CALIFORNIA, SALT LAKE CITY, UTAH

A 4-DAY CONFERENCE WAS HELD FOR CERTAIN CREATIVITY RESEARCHERS, AUDIOVISUAL FIELD PROFESSIONALS, AND EDUCATORS TO DISCUSS PROBLEMS IN THE DISSEMINATION OF CREATIVITY FINDINGS THROUGH THE AUDIOVISUAL MEDIUM FOR CLASSROOM USE. THE FIRST 3 DAYS OF THE CONFERENCE WERE GIVEN OVER TO 12 PROGRESS REPORTS AND DISCUSSION OF RESEARCH WORK BEING CONDUCTED BY THE VARIOUS PARTICIPANTS. PAPERS PREPARED ESPECIALLY FOR PRESENTATION AT THIS CONFERENCE WERE ATTACHED TO THE REPORT. THE FOURTH AND LAST DAY WAS DEVOTED PRIMARILY TO IDENTIFYING RECURRENT IDEAS IN THE PAPERS AND TO DISCUSSING METHODS OF APPLYING RESEARCH FINDINGS IN NEW MEDIA DEVICES FOR CLASSROOM USE. A VERBATIM TRANSCRIPTION OF THE SUMMARY SESSION INCLUDING IDEAS FOR FUTURE STUDIES WAS PRESENTED. (GD)

ED010651

B-501
(5-1018)

U. S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
Office of Education
This document has been reproduced exactly as received from the person or organization originating it. Points of view or opinions stated do not necessarily represent official Office of Education position or policy.

INSTRUCTIONAL MEDIA AND CREATIVITY

Report of the Torrey Pines Conference (August 31-September 3, 1965)

Calvin W. Taylor
and
Frank E. Williams,
Editors

UNIVERSITY OF UTAH
SALT LAKE CITY, UTAH

INSTRUCTIONAL MEDIA AND CREATIVITY

Report of the Torrey Pines Conference
(August 31-September 3, 1965).

Calvin W. Taylor
and
Frank E. Williams,
Editors

Supported by: U. S. Office of Education,
Cooperative Research Branch
Contract No: OE-5-16-001
Monitor: Thomas Clemens, Media Research and
Dissemination Branch

Department of Psychology
University of Utah

October, 1965

LIST OF PARTICIPANTS

Lester F. Beck, Oregon State System of Higher Education

Kenneth R. Beittel, Pennsylvania State University

Jack V. Edling, Oregon State System of Higher Education

James D. Finn, University of Southern California

J. P. Guilford, University of Southern California

Marie M. Hughes, University of Arizona

Donald W. MacKinnon, University of California at Berkeley

Ross L. Mooney, Ohio State University

Sidney J. Parnes, State University of New York at Buffalo

Malcolm M. Provus, National Education Association

Carl R. Rogers, Western Behavioral Sciences Institute

Calvin W. Taylor, University of Utah, Conference Principal Investigator

E. Paul Torrance, University of Minnesota

Frank E. Williams, University of Utah, Conference Director

Observers

Isabel Beck, Harbor College, Los Angeles, California

J. Ned Bryan, U. S. Office of Education

Edward E. Dudek, U. S. Naval Personnel Research Activity at San Diego

William A. King, U. S. Naval Personnel Research Activity at San Diego

L. C. Repucci, Dow Chemical Company

Taher Razik, State University of New York at Buffalo

History and Acknowledgements

The objective of this conference was to examine what is currently known about creativity with suggestions of how teachers could use or modify for use any existing media for creativity purposes and how new media devices and materials could be designed for evoking creative classroom behavior.

when)

As stated briefly in the Preface, the meeting was prompted by a conviction that psychologists and other creativity researchers were now at a period of concern about developing curriculum materials and ways for the teaching of creativity. A general appraisal of this progress and concern was now in order and could serve as a guide for developing media for future classroom use.

Research findings on creativity have been talked about by educators but to date little has been done in examining their nature for cultivation in the classroom via new media. And yet something new is appearing in education through the recognition that creativity is becoming one of its major objectives and that suitable classroom teaching materials are needed for its development. Major efforts in basic research on creativity have been conducted by a few leading people at various centers throughout the country and scattered attempts have already been made to translate these findings into books and materials for teachers' use in the classroom. It was indeed timely for a lively exchange and an overall appraisal of knowns, needs, and leads.

Various research centers throughout the country have been concentrating on creativity studies for some time. In Los Angeles, J. P. Guilford has directed a group of psychologists who have been at work over the last fifteen or more years on a project of high-level aptitudes. This group at the University of Southern California supported by the U. S. Office of Naval Research and others, has used psychometric approaches to analyze human intellect in general and to identify those mental abilities that contribute more directly to effective creative thinking. They have developed an analytical "Structure of Intellect" as a theoretical model of 120 abilities in the total human intellect which includes several abilities more directly related to creative production. Their work has now been expanded to how they think certain intellectual abilities may have some bearing on programming for the teaching of creativity.

In Berkeley, California a group of psychologists has been engaged during at least the past ten years in focusing attention primarily on discovering those traits which distinguish the more creative from the less creative individual. Under the direction of Donald W. MacKinnon at the Institute of Personality Assessment and Research, this group (including Frank Barron, Richard Crutchfield, Harrison Gough, and others) with support from the Carnegie Foundation has been interested in the problem of individual differences among mature creative persons in several fields. Recently they have also been trying to develop media to encourage creative thinking and creative action.

For over a decade in Salt Lake City, Utah there has been a sustained effort on a variety of projects that have run the gamut from the earlier intensive criterion and predictor studies of creativity (including relations between creative and communication abilities) to the most recent work on the development of a theory of education from psychological and other basic research findings. The Utah group under the direction of

Calvin W. Taylor has written extensively on the subject of creativity, and within little over a year has produced three major books from a compilation of findings that have been presented at the sequence of five Utah creativity research conferences supported by the National Science Foundation. Currently its work includes creativity research for the U. S. Office of Education, Peace Corps, Richardson Foundation, U. S. Air Force, U. S. Public Health Service, and the National Aeronautics and Space Administration (involving extensive biographical studies of 2,000 NASA scientists). The diversified work of Frank E. Williams in creativity over the past ten years at San Jose State and Utah has ranged from seminars and training in industry to conferences and workshops for teachers. A most recent work and interest of his at Utah has been a review with Robert M. W. Travers of research on new media as it relates to communication and information theories, and a study of the development of films, filmstrips, and workbooks for teacher's use in order to bring about creativity in the classroom.

In Ohio, Ross Mooney has been personally struggling with and writing extensively about the meaning of creation and creativity for many years. Principally his work and writings have been in recognizing creativity as it occurs in nature and society, as well as in the more intimate events of personal creation. His interest has been in developing highly abstract intuitive models of creativity. Through the teaching of people in education about perception as a creative phenomena, his work at the Bureau of Educational Research, Ohio State University has been a constant pursuit for the revelation of creation and its effects in various cultures and institutions.

At the University of Minnesota, E. Paul Torrance has been the director of the Bureau of Educational Research for the past six years. Now as a professor of Educational Psychology, he continues to be involved in work dealing with the development of creative potential in the educational process. Most of his prolific work has been concerned with the kinds of teacher behavior that would be conducive to the optimal development of creativity. His main interest has been concentrated upon the translation of research into instructional materials by way of changing teacher behaviors through provision of diverse materials for teaching creativity. He has produced a series of widely known verbal and non-verbal creativity tests with scoring criteria for teacher's use. Now his work involves the development of books and films to be used on an experimental basis by classroom teachers.

Sidney Parnes, State University of New York at Buffalo has been conducting annual institutes and courses in creative problem solving for the past nine years. The work of this center includes research on methods of teaching creativity to adult groups, and at the present time he and his associates are working on a national project for programed instruction in creativity.

On the basis of their work in audio-visual research and educational programs for teaching classroom creativity, we selected the three instructional media specialists, Lester F. Beck, Jack V. Edling, and James D. Finn, after conferring with Thomas Clemens, the project monitor. We then expanded the conference plans to include several additional participants before final contract negotiations were completed with the U. S. Office of Education. We invited Carl R. Rogers to serve as a special consultant and discussant from psychology and Marie Hughes to serve in a similar role from education.

We asked Kenneth Beittel to report on his novel approaches to creativity research in art education and Malcolm Provus to present his research materials and experiences with situational testing for creativity at the Chicago public schools. A few days prior to the conference we learned that Joe McPherson of Dow Chemical Company in Midland, Michigan had just finished an introductory film on creativity entitled "Ape to Agape;" it turned out that his colleague, Larry Repucci, was able to attend the latter part of the conference and present this new film together with background information about its production. U. S. Office of Education displayed further support and interest by sending one of its representatives, Ned Bryan, their key staff person on the Talent Developments Project of the Cooperative Research Branch, as an observer. Taher Razik, a research colleague of Parnes, and Isabel Beck were also present as observers as was the local host, Edward Dudek, and some of his staff from the U. S. Naval Personnel Research Activity in San Diego.

These, then, represented the people, the crucial elements of a conference. Let us next learn more about the special qualifications of these additional participants.

Two are psychologists who are deeply involved with learning via the new media. One of these was Lester Beck, Research Professor of the Oregon State System of Higher Education in Portland. His work and interest has been in the design of films to assist teachers to do a more constructive job of teaching. One of his concerns is with the design of media for pre-school children in a form to be used on television so that they will have a better set of creativity learning strategies developed by the time they enter first grade.

Another participant selected because of his work in applying psychology to the mass media of television and educational films was Jack Edling, Professor and Director of Teacher Research, with the System of Higher Education in Monmouth, Oregon. As director of the Teacher Research Division, he is associated with people from California, Indiana, and Michigan who are all interested in efforts toward programed learning and in discovering how such devices might affect the learning of creativity.

The third media specialist was James D. Finn, head of the department of Instructional Technology, School of Education, University of Southern California. He is the principal investigator for the Technological Development Project of the National Education Association under contract with USOE and was invited as a special consultant on the current status of technology as applied to the field of education.

Carl Rogers of the Western Behavioral Sciences Institute in La Jolla was invited to attend as a special consultant to react to several of the papers of the creativity researchers. Certainly not a novice in the field of creativity, Rogers had presented his first paper on a theory of creativity in the early 1950's at the Barkan-Mooney creativity conference at Ohio State University. His insights as a creative individual, counseling theorist and researcher, and reknowned leader in the behavioral sciences added a remarkable flavor to the conference.

Many educators have made important attempts to promote classroom creativity. Therefore, it was important to select as participants those educators who were most knowledgeable in the field of creativity who have been working to bridge creativity research findings into practical implications for classroom teachers. One of the most noted professional educators who has worked throughout the years in public schools from kindergarten to university graduate training for teachers is Marie Hughes, Professor of Education at the University of Tucson, Arizona. Her work with Taylor in connection with his creativity research and workshops at Utah, her own research with teachers and pupils at the University of Utah experimental school in the teaching of the higher mental processes including creativity and productive thinking, and her deep involvement with the interaction process greatly qualified her to be selected as an educational consultant to the conference. She has done considerable research on the transactional process of the classroom between the teacher and the pupils, or between pupil and pupil. These data indicate the vital importance of pupils' becoming creative through the conditions set by the teacher, opportunities provided, and the resulting interactions that take place.

In Pennsylvania another eminent researcher, Kenneth Beittel, is carrying on the work of the late Viktor Lowenfeld on the interdisciplinary aspects of creativity in art education. Beittel and his associates have been interested in how creativity relates to a person communicating with himself in the evaluative phase of his art production. Their major concern has been how art educators can facilitate a student's processes when he is attempting to create through art. By means of factor analytic procedures, they have discovered in the visual arts some of the same qualities possessed by creative artists as other researchers have found among creative scientists. Thus, regardless of field, it appears that there may be some basic traits upon which the creative processes rest.

Another educational participant who has said that if we are serious about putting creativity across in schools, it will be necessary to get rid of words, is Malcolm Provus. He is now a Director of the Special Time to Teach Project for the National Education Association. Over four years ago Provus started developing new methods and situational materials for the Chicago schools in the teaching of creativity. He brought to the conference his wide experience in designing studies for teacher in-service training programs and how these might include creative processes.

After excellent groundwork by Edward Dudek, we selected a scenic and inspiring site most worthy of the conference topic, the Torrey Pines Inn, which overlooks two golf courses and the Pacific Ocean. This setting was also chosen because of its quiet and relaxed atmosphere, somewhat isolated from a large city and yet not far from Los Angeles where the 1964 annual meetings of the American Psychological Association were to be held the following week.

Thus the stage was set. The conference was unique in composition. Virtually all of the creativity research conferences of the past consisted primarily of psychologists and other behavioral scientists who had been engaged in the process of conducting research and writing articles and reports about creativity. At the present conference, however, other psychologists and professional educators were present who had devoted a major part of their research lives to an examination of learning, to developing and teaching courses, and to designing films and other audiovisual materials. Strange as it may seem, this was the first time creativity researchers had been brought together as a group with leading professionals in the audiovisual field and selected educators to discuss problems involved in the dissemination of creativity findings via the audiovisual medium for classroom use. Researchers and educators were now going to examine together the nature of creativity toward the development of audiovisual teaching methods and materials and to share together their knowledge about creative individuals and creative processes in a fresh, new approach.

The first three days of the conference were given over to a lengthy series of progress reports and discussions of research work being conducted by the various participants. The papers of the participants were prepared before the conference as requested by the project director. Stocktaking sessions were held briefly at the end of each day to keep adequate focus upon the problems of applying creativity findings to the development of new media devices for classroom teaching.

The first paper in this book represents an extension and revision of a report by Taylor produced for the ASCD (NEA) project on a theory of instructional materials (directed by Chandois Reid and supported by the U. S. Office of Education), which was specifically prepared as an outcome of the St. Louis Seminar (May 19-23, 1960) of that project. This earlier project initiated his experience with these combined topics of instructional media and creativity. His early exposure to this area also led to sustained thinking and further speeches about it, with additional pertinent ideas generating as a result. He is also indebted to the U. S. Office of Education for support on the theory of education project. This project extended his thinking beyond creativity into other high-level talent areas and caused him to grapple with the all-important problems of bridging the gap between basic research findings in the behavioral sciences and their implementation into educational practices. Instructional media specialists can do a great deal of the "educational engineering" work that is sorely needed in bridging this gap.

Two other presentations require special comments about features that have not been fully captured in this volume. The first was a fascinating demonstration by Lester Beck, showing how the editing of existing sequences of film could be used for leading classroom pupils into some of the processes of imagination and creative thinking. The second was a series of slides and comments by James Finn which highlighted the man-machine symbiosis that characterizes the heart of the term "technology" as he uses it in his approach to problems of the educational community. In this approach he stresses the functional interrelationships between the learner and the equipment, including the different processes that the equipment could evoke in the learner. Samples of Finn's published works are cited in the bibliography together with the new book by McLuhan "Understanding Media: The Extensions of Man," to which he drew special attention.

The fourth and last day was devoted primarily to identifying recurrent ideas in these papers and to synthesizing preceeding conference papers with guides as to how the research findings presented throughout the previous three days could be directly applied to new media devices for classroom use. A final chapter of this report presents the verbatim transcription of this session plus a summary of specific points that may be considered for incorporation into the design or use of new media devices in order to evoke creative behaviors. This chapter also presents a list of ideas out of which future studies may be generated.

Two copies of the paper presented by each participant were given to the project director and it became his responsibility with the help of other staff members and the research laboratory facilities to prepare a draft report from the papers and the tape transcriptions. An agreement was made between all conferees that each one would take the initial responsibility of editing his own transcribed paper for inclusion in the final report. Also, copies of the stocktaking session of the last day were distributed among all participants for their selective editing of what in their views were the major themes, principal conjectures, and the most striking tentative conclusions reached. The preparation of the total report was greatly aided by the comments and help of all participants. Williams was principally responsible for writing the final summary chapter although every effort was made to reflect the thoughts of each participant. The summary chapter was undertaken in the spirit of trying to find a consensus of knowns, needs, and leads that recurred throughout the four days. Among other things, the final report can serve as one of the guides for future programs of the Media Research and Dissemination Branch of the U. S. Office of Education.

In a cooperative enterprise such as this, there are many people who deserve special gratitude. Sidney J. Parnes helped us further in chairing some sessions of the conference, as well as having initiated the whole idea and having made the first arrangements toward its occurrence. The total work both prior to and after the conference was enormously facilitated by the hard and constant labors of Mrs. Connie L. Jensen, who expedited countless details such as handling all of the mail and phone correspondence, assisting with the agenda and scheduling conference activities, helping with the editing of tape transcriptions, and typing the final report. Mrs. Mary Fitch and the staff at the Torrey Pines Inn made all of the housing and conference room arrangements. And our acknowledgement is extended to William King of the U. S. Personnel Research Activity who watched closely over the recording systems and changed the tapes on both machines throughout the entire proceedings. The excellent tape recorder and transcribing equipment used in producing the final report were provided by a grant from the Richardson Foundation.

It would be difficult to express sufficient thanks to the many people who have spent countless administrative hours listening to and transcribing from tapes, typing transcribed drafts, and preparing the many pages for the final report. For this work special recognition should be given to Grettle Haglund, Judy Frandsen, and Barbara Mortensen.

Finally, special appreciation is expressed to Thomas Clemens, the monitor of this project, for all his help in the organization of the conference, for this great devotion to his responsibility, and for his vision in foreseeing the need to disseminate widely the final report of the conference and the ways to accomplish it. We are further pleased to announce that through his alertness to new ideas, a grant awarded to Lester F. Beck from the National Defense Education Act (Title VII, Part B) is now in the process of designing and producing such a film to be circulated nationally. The film will include the four interrelated parts of creativity versus intelligence, factor theory and personality theory of creativity and teaching for creativity via various media devices. It will show the conferees in a round-table, informal discussion of attempts for developing creativity in the classroom with numerous examples of materials and techniques developed for this purpose.

Calvin W. Taylor & Frank E. Williams

June 1965

PREFACE

In late August 1964 some fifteen of this country's leading psychologists, researchers, and educators gathered for four days at Torrey Pines Inn at La Jolla, California to discuss how instructional media might help foster and encourage creativity in our primary and secondary schools in America. This conference, the sixth in the Utah creativity research conference series, was supported by the U. S. Office of Education which, through its Media Research and Dissemination Branch, has been interested for several years in the long range problem of improving the dissemination of psychological research knowledge on creativity for use in classrooms. The intention of the conference was not to formulate immediate decisions, but rather to explore current fundamental findings on creativity and how these could best be imparted by classroom teachers through the use of audio visual materials for young students.

The general purpose of the conference can be briefly explained by stating its five major objectives: (1) to convene a small group of highly competent researchers of creativity and educational media to discuss the relationships between these areas of investigation; (2) to translate suggestions from what is known about creativity for (a) identifying existing media already suitable for creativity which can be widely implemented without changes, (b) developing the potential of existing media, and (c) designing new instructional media to be used by the classroom teacher to evoke more creative experiences and behaviors in students; (3) to summarize the current literature on creativity and on educational media which holds promise for improving the production and/or use of instructional materials for creative ends; (4) to identify additional needed research on the relationship of instructional media to developing creative behaviors in the schools; and (5) to produce the results in a report suitable for widespread publication.

Perhaps the one person who at first generated the most concern for an appraisal of creativity research as it applies to instructional media for classroom use was Sidney J. Parnes, Director of Creative Education, State University of New York at Buffalo. It was originally his idea and contacts with the U. S. Office of Education that formulated the initial plans for developing such a conference between creativity researchers and educational media experts. Part of his important planning progress included the alerting of five other creativity researchers.

While visiting in the U. S. Office of Education, Calvin W. Taylor, who was among those so alerted, had met a staff member of the Media Research and Dissemination Branch and had inquired about the likelihood of the proposed conference materializing. As a result of this meeting he furnished that branch an informational copy of his earlier mimeographed paper on "Instructional Media and Creativity" plus the NEA Jouranl reprint on "Bridging the Gap between Basic Research and Educational Practice" (Taylor, Ghiselin, and Wolfer, 1962). Shortly thereafter, Thomas Clemens reacted very favorably to these papers by stating that they were both very central to the interest of his branch which has a major mission of implementing basic research findings into educational practices.

Later Parnes discovered that he was not in a position staff-wise to carry through with plans for an interdisciplinary conference. He contacted Taylor and asked if he could become the principal investigator and with his staff could take over the proposed project because of his considerable experience with such creativity research conferences. Fortunately, Frank Williams was available to help as project director during his final year at Utah prior to accepting a new position at Macalester College in St. Paul.

We expanded the list of participants to obtain a balance among creativity researchers, instructional media specialists, and educators knowledgeable in both fields. After receiving invaluable advice from Thomas Clemens, the project monitor, we were able to attract and assemble the outstanding group of participants listed on page . As always, we openly recognize that the participants are the all-important part of a conference and that the success of the conference is almost entirely due to their contributions.

Details of the genesis and staging of the conference, of the background of the participants, and of the production of this final report, together with our appreciation to each person who helped in the entire enterprise, are contained in the Appendix in the section entitled "History and Acknowledgements."

While preparing the final report, we decided especially in the first chapter to retain the same spontaneity for the readers which had proved to be of great interest to the highly capable participants. In this way we tried through this report to illustrate how instructional materials can be presented in forms which will lead to more creative learning and experiences in the readers.

We also feel that the initial chapter illustrates one successful way in which to start a conference. The opening paper takes a position on each of a series of pertinent, though controversial, points and not only provokes thinking but also permits lively discussion on each point as it arises. Most persons had soon been stimulated to participate by reacting primarily to some point in the flowing discussion rather than by entering for status-seeking purposes. All participants have been identified by name in the first chapter as they entered into the discussion, in order to give the reader experience with this style of reporting.

Our experience suggests that the reporting of the live discussion among leading researchers is one of the more provocative styles of presenting information. It has the extra advantages of giving the reader several direct indications of the early state of knowledge about many of the subtopics and the tentativeness of the early thinking and the early statements in the field, a communication problem about which Carl Rogers displayed great concern at one point in his discussion in the first chapter. We also believe that such material might increase the students' total amount of thinking on the topic and that any teacher would find it difficult to teach solely by authoritarian means if their students used textbooks containing such discussion materials.

After the first chapter, two symbols have been used to indicate when the discussion changes from one person to another (in place of the more expensive process of identifying each discussant). These symbols appear at the beginning of a paragraph and their appearance indicates a change of person in the discussion.

S: The speaker giving the report is doing the talking; S is therefore also the author of the chapter.

C: A participant, otherwise unidentified, is making a comment or raising a question; C therefore refers to any discussant.

Occasional chapters of this final report have reverted to more customary and more formal styles of presenting information--which may seem easier for some readers since it more clearly fits their habit patterns and expectations and thus presents them with less of a struggle. However, as creativity researchers we recognize that educational experiences have not yet programmed most people toward more creative performances. Therefore, the task facing us is not to design media which will best fit the expectations and old habit patterns but to do the reverse--to make a breakaway attempt to construct new media so that more creative patterns of thought and learning are cultivated.

One of the unusual features of this conference, as pointed out later by William King, was that each of the topics of creativity and instructional media can apply "across the board" to all disciplines and areas of human activity. Both topics, being interdisciplinary in nature, are therefore almost unlimited in their potential areas of impact. And yet, previously, there had never been any serious and systematic attempt of any major magnitude to put them together.

The timeliness of getting specialists from each of these two areas to exchange and interact was most noticeable. Afterwards both groups volunteered that the cross fertilization was most effective and that the exchanges were extremely provocative. And so, as an outcome not entirely unexpected prior to the conference, these exchanges uncovered almost unlimited challenges ahead for those willing to venture into this new combination of fields. We therefore invite the reader to seek out one or more challenges of his own and thereby add some of his efforts to this new area.

Calvin W. Taylor and Frank E. Williams

June 1965

TABLE OF CONTENTS

Page

LIST OF PARTICIPANTS. i

HISTORY AND ACKNOWLEDGEMENTS. ii

PREFACE. xiv

CHAPTER

1. Instructional Media and Creativity: Part I
   Open Discussion of Participants led by Calvin W. Taylor 1

2. Instructional Media and Creativity: Part II
   A Universe of Challenges. Calvin W. Taylor 64

3. Basic Problems in Teaching for Creativity
   J. P. Guilford 104

4. Existing Instructional Media in Relation to Creativity
   Jack V. Edling 152

5. Some Personal Observations on Creativity
   Malcom M. Provus 181

6. Implications of Creativity Research Findings for Instructional Media
   E. Paul Torrance 215

7. Instructional Media in the Nurturing of Creativity
   Donald W. MacKinnon 261

8. Use of Films and Television for Creative Teaching
   Lester F. Beck 317

9. Imagination Developed and Disciplined
   Sidney J. Pa 328

10. Creation and Instructional Media
    Ross L. Mooney 376

11. Instructional Media for Creativity in the Arts
    Kenneth R. Beittel 405

Page No.

12. Stocktaking between the Areas of Creativity and Instructional Media
Open Discussion of Participants led by Calvin W. Taylor and
Edited by Frank E. Williams 447

13. Overview with Models and Summary Lists of Tenable Ideas and
Research Areas
Frank E. Williams 517

REFERENCES 555

Chapter 1

Instructional Media and Creativity: A Universe of Challenges[1]

Opening Discussion of Participants

Led by Calvin W. Taylor

Taylor: Little is known through research about the effects of various instructional media on creativity. Consequently, not only research work but also considerable developmental work on instructional materials and techniques will be required before installation into the classroom (Taylor, et. al., 1962a). The research findings on creativity that formed the basis for this report are largely taken from the five Utah research conferences on creativity (Taylor, 1956, 1958, 1959, 1964a, 1964b--see also 1963).

Though the ideas herein are educational implications from basic research findings, they are practically all speculative and could all be introduced by the question, "Is there any merit in my hunch that . . .?"

Creative talent has been relatively ignored in the identification and development of talent in educational programs to date. For example, Hutchinson (1964) recently completed a dissertation which he called "Productive and Creative Thinking in the Classroom." He tried to cultivate creative thinking abilities in the classroom and worked real hard on it. During his study at one recess time when the students went out in the hall, he followed them out there, too. He found all the things that he had been trying to have happen in the classroom were occurring spontaneously in the hall. He wondered how could he ever get that intellectual liveliness into the classroom that was happening rather spontaneously out in the hall?

---

[1] This first presentation at the conference brought about such fruitful discussion that all remarks are included in this chapter as they emerged. Our hunch is that the chapter is more provocative reading with the discussion retained and with the participants identified. And this initial paper was vital in stirring full discussion among practically all participants and thereby setting the stage for a most lively conference thereafter, a more creative conference--indeed, an experience in creativity.

MacKinnon: Have the classes in the hall.

Torrance: Have a longer recess.

Guilford: Have stimulation in the classroom--such as that in the hall.

Taylor: The best technique I have found for use with teachers is the one which James Gallagher gave me. You tell them "Let's play the creativity game for a minute and be flexible and flip things over 180 degrees and see how something looks by an opposite approach." Then you ask the question, "If we were to design a classroom program or a school curriculum which was the best possible for the following goal, what are some of the specific features we would build into the classroom program? The goal is to do all you can to design a program that would be most effective in stifling or killing creativity." And then teachers start generating all the specific things that they feel would have this effect. After awhile, I ask "What does it all add up to?" Almost invariably someone responds promptly that "This is what we already have in many classes." So not only is it possible that creativity may have been relatively ignored, but even worse, in many cases, creativity may have been discouraged, stifled, and killed.

Yet, creativity may be equally or more important than the intellectual characteristics incorporated initially into educational programs. Furthermore, Torrance (1964) has suggested that perhaps many things may be learned creatively more economically and effectively than by authority. Recent research on human characteristics has indicated that a large number of other thinking and learning processes have also been largely ignored in the identification and development of talent in education. Our educational report (Taylor, et.al., 1964) proposes that all of the known learning and thinking processes should be experienced in students at one time or another while they learn subject matter content. Consequently, we feel a need for techniques and instructional media which are most effective in developing, in turn, each of the known intellectual characteristics, including creativity.

These unfortunate oversights will not automatically be overcome with the emergence of new instructional devices, such as television and teaching machines, because most developments to date in these new media tend to preserve traditional educational practices.

I do not think that the inclusion of creativity in the curriculum will occur too rapidly. Generally with these new techniques, workers tend to find out what is already going on and try to match these through using the new techniques and hopefully to accomplish the same things more efficiently. The real possibility for creativity is they might accomplish the same things more efficiently so that time could be left over,uncommitted time. And then creativity has its chance to compete for that uncommitted time. But otherwise the tendency is to do what is already being done, only by different ways, and to accomplish the same learning and use somewhat similar learning processes as before.

These new media tend to focus on the transmission of certain standard subject matter without great attention to the nature of the thinking and learning processes in the student while subject matter is being transmitted. Teaching-machine specialists usually program to accomplish the same learning as traditionally occurs in the classroom, only with more efficiency. Few teaching machine specialists have yet paid attention to the problem of developing creative thinking or other newly found thinking and learning processes in students.

The best evidence I have of this is that programmed learning people have had considerable financial support but at one stage in the early 1960's only one small bit of this support, in the order of two or three thousand dollars, had been devoted to creativity through teaching machines. And yet total support for programmed learning by that time had been in the millions which indicates again that there was a sizeable group of people designing programmed learning devices practically without any thought given to include creative thinking. Furthermore, at that time I felt that those who are most likely to bridge between these two fields were creativity researchers, not teaching machine or TV media specialists.. I have always had difficulty in getting research support in creativity of any magnitude or for any long sustained effort. It has been a tough ball game because too many have apparently believed that nothing can be done or creativity is too complex or nebulous or something. This excuse is vanishing to some degree but it has certainly been a strong part of the picture in the past.

Parnes: You're painting a sad picture here. We might look at it the other way too. There has been a lot of growth over the last five or ten years. Of c ourse, in terms of what needs to be done, it is a drop in the bucket.

Taylor: We're impatient now.

Parnes: Yes. . .that's right. I am not saying that we shouldn't be. I feel the same way when I look at my own efforts. I see so much that ought to be done! But then when I look back to where we have come from, where we started, then it becomes a little more encouraging.

Taylor: Maybe it is tremendously rapid progress, in comparison with how things often go.

Hughes: But we always have to remember that one lives a year just once. An individual lives a year just once and never goes backwards so we need to be very impatient.

Parnes: That's right. The progress that has occurred does not really give much consolation to the child living in the system right now.

Taylor: A key NEA public relations person in Washington, D. C. spoke to me once and said: "I wonder whether any of these creativity research findings will ever have an impact on the lives of any of my children." So we have arrived at a period of impatience.

However, when I first looked across these two fields, three or four creativity researchers were planning work that would bridge between new instructional media and creativity. Let me give a few examples of people in creativity who had been thinking about utilization of teaching machines. Major Bert J. Decker of the U. S. Air Force presented a paper on June 27, 1961 on "Teaching Machines and Creative Behavior." He said that "We need everyone in the creative programming act. We need every kind of talent and skill. Further, we must have diversity, not only for creativity's sake, but because 'he who holds the programming Heartland controls education' and no small group should--or will--control education in this democracy."

So you see that because of America's usual committments to gadgetry and to machines, he may have felt that someone can come out with a programmed system and this will have a great impact on education. If some of these new research areas such as we represent do not get into that initial system, we will have a hard time thereafter.

Edling: I have a comment on that last one. You know I have been fighting with this mass media business for a long time. Everyone has this fear but it is all from fiction. Many books and literary works--these imaginative, subjective things that people have brought up--have colored reality. People have developed a real fear of control and the media are struggling under this false notion that has been developed. This is something that we in instructional media must continually face. The fear is that somehow or other media, if they become really effective, are somehow or other going to control man and man's behavior. This is apparently the fear of many professors.

Provus: I don't have to read these books to have this faar. I think much of the new media does actually seize control--including control over some of the very important processes that we are trying to foster at this conference.

Edling: Well, I am very opposed to this position. I think that this is just one small factor in society and that if the things that the media are communicating about is in fact reinforced by environmental events then that is O.K. Then this may make people look at things in a different way, such as any of the work in motivation research about selling of products or getting people to do a particular thing. If, in fact, whatever would be advocated by the media were not again reinforced by environmental events, then the message would not really have much effect.

Provus: All I am saying is that I think much of the new media robs the pupil of initiative.

Edling: No, I don't believe this.

Parnes: It depends what you are comparing it with. For example, if you are comparing a TV program of a lecture session, I do not see that it robs them of very much initiative as against the lecture session with 300 students.

Provus: No, I think even here.

Parnes: You think even there? Why?

Provus: The learner doesn't have another student sitting next to him to poke in the ribs, to crack a joke, to break it up a little bit. Anything, that increases his life space is to be desired.

Guilford: I think one of your answers to these critics is that ordinary teaching also exhibits the control of individuals.

Taylor: Let me insert one bit of our research evidence which argues against too much control of one's total life during the school years--against too much saying that "we know" what a student should be doing at this time in his life and at that time in his life, not only during the school day period, but also when he goes home at night--in homework assignments and so on. Why should we act so sure that "we know" all the things that he should be doing? I feel that the tendency after the Sputniks was for education to become excited and scared and to start pouring it on and doing more of the same in the form of longer hours, longer weeks, longer school year, and more homework assingments. But our studies of NASA scientists show a pertinent result. We compared those who had been more creative with those who had been less creative in their total careers. They all recalled back when they were school age and were asked when did you learn more when you were school age? (a) In the classroom; (b) when you were doing homework assigned by the system, or (c) when you were out of school learning something on your own?" And the more creative they were, the more they answered this third choice C. And yet some tendencies have been in the reverse direction to swamp the system so they wouldn't have any time for learning on their own what they happened to become interested in learning at any particular time.

Guilford: I agree on this point of initiative.. The teaching machines so far have not given the learner much in the way of problem solving. They have been pretty much passive listening, and being led by the hand consisting of easy step-by-step learning.

Taylor: Hutchinson's dissertation indicated that as much as 40% of the students' comments in the classroom were on this order: "Teacher, exactly what am I supposed to do? Teacher, , exactly how am I supposed to do it?" Though I am exaggerating a wee bit the students were working under real close supervision but so many of the students questions were "How do I work under your c lose supervisior and what do you want done?"

MacKinnon: What I would like to stress is that I don't think we really have the facts here. I have just returned from France and found school children let out at 7:00 in the evening after a long, tense day with a great deal of control, if you will, restraining them. And moving around France in a very creative culture I was faced with the following question, having remembered some things I have already written. Is it true that if we do create **more** freedom that we really are going to nurture creativity? Or how is it that the French children can have the kind of education which they have and yet be part of a culture that is outstanding for its creativeness? I don't have any ready answers. I'm not ready to jump to either side; I don't exepct to control freedom.

Torrance: I wonder if in that life space one of the differences might be how much creativity. I am thinking particularly of the imaginative stories that the French children wrote compared to other cultures. I think the French children found it easier to engage in fantasy and imaginative activity than the others.

MacKinnon: How could they do it with the kind of restraints and controls placed upon them in the school?

Guilford: An escape mechanism.

Provus: It is one thing to be subjected to authority and another to be actually controlled by it. I suspect the kids in the French Lyceum are not particularly controlled by that **authority.**

Edling: They have additional stimuli over there. I remember encountering one little French boy coming home from the grocery store with a little wine bottle that his mother sent to get. And every once and a while he'd stop and have a swig.

Hughes: So far as France is concerned, I think you have to look at two things. First, you have to look at the child-rearing practices and there are some very interesting data in terms of French child-rearing practices as against American practices. And second, when we think of restraints we have to attempt to define whatever the limits are and there one of the things that I would think would help is that the demarcation is always clear. That is the delimitations in the traditions are pretty clear how far they go. And intellectually the restraints, at least as I understand the Lyceum, are somewhat different from ours. Ours really are in the intellectual field. This question with this answer and no other answer. Whereas in France it is this answer but it is within a much wider area of probing.

Rogers: This is one thing I want to know. Do you feel that the teachers in the French situation value the creativity or the fantastic, or are they pretty traditionally bound in their own view of this?

MacKinnon: I just don't know. But I just bring up this point because I think in our discussion we have to. This is the point I want to make--think not only what goes on in the classroom, but think of things in terms of the culture--because the French culture is different from our culture. I think we tend sometimes to focus our attention to what goes on in the classroom without also seeing what goes on in the child rearing practices of the society at large. If you travel from culture to culture you recognize how important it is to take this very important variable into consideration.

Taylor: A few things come to mind on this point. One is that Hudson in England (1963) did studies of some of these thinking tests. He found that the students in the liberal arts scored higher than the students in the sciences, which may suggest that they are allowed more chances or even encouraged to do more thinking of their own in one area of study than in another area. Then Bloom (1958) indicated from his observations on a trip to India that creativity come out in the areas of human activity in which it had a chance to come out in a culture but not in the areas in which everything was well defined. I also recall the statements of a graduate of Annapolis, who said that he was stunned at both what happened when he was in the highly disciplined situation at Annapolis and also what had happened in military history--that at crucial times in military history, unusual creativeness has cocurred at the right time and the right place or at least has made a big impact. And he said that at Annapolis in a very tight system, inventiveness came out in a variety of ways.. after hours or on the side.

Apparently we are talking in about open versus closed systems here of some kind or they may be internal versus external systems. What is allowed to be expressed at this particular setting versus what happens then when persons contain themselves but later let out steam in another setting so that what goes on internally, never comes out within the context of the system. You may really stimulate a great deal of varied thinking inside people if you impose too tight of a closed system on them.

Beittel: One of the most contradictory aspects of the French system is that their art training is extremely traditional and rigid. Manuel Barken reported that of all the countries he studied, France has the most rigid art training and yet they have been the most influential country in modern art. This is a curious contradiction. So much so. that a French artist when interviewed, lived personally almost like a schizophrenic. He had to go to school, he was a high school teacher, he taught this rigid traditional stuff that was even behind the academy back in the old days. And yet on the other hand he was exhibiting his art at one of the leading studios in Paris. Things were just out of touch with each other.

Torrance: This is demonstrated in their imaginative stories, too. They are written on note paper that not only has lines but has several sub-lines in between, and the letters have to fall between the lines only. Even with that they still write very imaginative stories. But they were very conforming in their handwriting.

MacKinnon: I think someone young in orientation always thinks in terms of opposites and the reconciliation of opposites which are important in creativeness. And the feeling I had in some of my observations in France this summer was that in the classroom there was a great deal of discipline and when the children got out of school they seemed to regress in their behavior. They are very unsophisticated, very young in their responses compared with American children so that though they are getting the sophistication in the intellectual realm in school they are very unsophisticated in their social behavior outside the school situation. One day we came across a very young boy sailing his boat which he had built. We'd say he was a very undeveloped, backward child. And yet he could speak English fluently. He obviously, as we fell into conversation with him, was a very bright and a very original sort of person. So it seems to me that he illustrated quite beautifully the fact that sophistication in the French child is the intellectual realm and yet he may be a very unsophisticated type of person. They have the expertise that they are getting under rather rigorous--rather rigid, I think one would say--educational system, and yet freedom in other areas. Again this brings me to urge us to consider our topic in the modern context of this society as a whole.

Edling: I objected earlier to Decker's statement that he who controls the programming heartland controls education--and programming here refers to the teaching machine context and the preparation of materials. And almost all the evidence that has just been given around the table, I think, confirms this notion that this isn't a true statement. There is a lot of research, such as Beck's research on the use of program materials, that shows the major variance in the use of materials, is contributed by the teachers. In program materials, the teacher variable is the largest environmental factor. This is the large variable. But to make Decker's statement is just like making the statement that he who writes textbooks controls education. It just isn't so. . .there is more to be said about it than this. This is not a complete statement.

Taylor: Provus also feels that teacher variables are more important than instructional media variables.

Provus: I would think that one of the things that this conference just might be able to do is to indicate the possibility that someday new media will have the force to provide the total educational direction of the child. I'm sure we'll have a better idea when we are through here. I think the kind of interaction process that Marie Hughes has been studying will help us to have a better idea of what such programming would look like. It has to take into account many more variables, many more contingencies. Perhaps we can do this somehow with new technology. You know it just might work out that he is right.

Edling: No, this is exactly my point that all this business on brainwashing is an example. What you are hoping for, your dream about the potential of educational media is not very sound because educational media cover only one factor in our environment and unless you can control all other factors such as the home, the teacher, and everything else, then media aren't going to be all pwoerful--this is unrealistic.

Provus: You could call Socrates just one educational medium but he made a tremendous impact.

Taylor: At the time when a total of about three million dollars had been spent on HEW teaching machine research, only $2,156.00 had been spent on programming related to creativity, on Dr. Day's project at the University of Nevada on "Programming a Teaching Machine Course in Thinking and Problem Solving." Barlow of Earlham had one research project in which he gave the student two alternatives had the student ascertain that neither one was correct, and led him to developing a third. "This teaches the students to think for themselves," claims Barlow, and Decker doubts that anyone would deny it.

Klaus of the American Institute of Research has developed a program "for teaching independent thinking and judgment". in art appreciation and geometry and, although they are not the all of creative thinking, they are important parts of it.

Decker's point is that teaching machines will not necessarily curb creativity. However, one expert claims that "teaching machines will increase creativity terrifically but only if we plan it that way and really work at it." Decker says that it will not just happen; we will either make it or not make it happen.

Under a grant from the Carnegie Corporation, Crutchfeld at the University of California at Berkeley is directing a research project which has to do with this broad topic: Facilitation of problem solving and creative thinking through the use of auto-instructional materials, using a number of different approaches to the problem. The ultimate aim is a multi-faceted approach which will involve "training" of various intellectual skills and attitudes bearing on the creative process. For example, among other things they are working with programs having conceptual inferences, and with the evaluation of problem information.

Parnes at Buffalo hopes to undertake research activity designed to ascertain to what extent can auto-instructional materials provide for deliberate development of students' creativity and at the same time assure mastery of subject matter? Incremental programs that already exist in the physical and social sciences will be modified in such a way as to permit their integration with creative thinking principles and procedures. The existing programs will then be compared experimentally with those to be developed.

The principal hypothesis to be tested is that creative behavior can be significantly increased through the modified programs and, at the same time, the mastery and understanding of content can be held constant or actually increased. A secondary hypothesis is that students' interest in and attitudes towards the courses being taught will improve as a result of such modified programs.

Specifically the research of Parnes will set out to accomplish the following: (a) Reduce all conventionally named aspects of creativity such as originality, sensitivity, flexibility, and fluency to their manifestations; that is, to actual behavior which indicates creative traits and attitudes. (b) Devise means of immediately reinforcing any slight tendency towards such creative behavior.

(c) Integrate such means of reinforcement into science courses (one in a physical science,--physics, and one in a social science,--economics) for which programmed materials have already been prepared by others. The existing programs will be completely revamped, with additional error analyses as necessary. (d) Evaluate the program's words and phraseology to determine whether they portray the principles being taught as unchanging laws or as dynamic guides to creative action. If they portray the former, they will be changed to portray the latter. (e) Ascertain, by using experimental and control groups, to what degree these integrated means and revisions improve the effectivensss of the programs in terms of creativity development coupled with content mastery. (f) Establish principles of integrating creativity into incremental programming.

The revised materials developed during the Buffalo research project (programmed for creativity as well as for subject matter) will be compared with the original subject matter programs. After pre-testing of both groups, the experimental group will study the creatively modified program and the control group will study the unmodified program. Post-tests will then be given to both groups in order to determine: (a) the degree of change in students' creativity (on standardized tests and in solving problems in the subject) and (b) the degree of change in the students' mastery of and attitude toward the subject matter.

In considering powerful mass communication media, we should recognize that there are potential dangers as well as positive features in them. That is, either positive and negative impacts could occur from them. Consequently, I think we should boldly proclaim, as in political campaigns, that equal time be devoted to the new approaches, to new findings. If some of these new approaches are TV, teaching machines, and programming, and others are the new research findings about creative and other important human characteristics which we are just starting to learn how to identify and develop, then we should give equal time to each until someone demonstrates that the new instructional media are taking care of both. As another point of hope, if these new programming approaches do manage to make time free, then creativity has its chance to take its turn in the curriculum.

Beck: We should recognize that all instructional media per se are simply instruments in the hands of the teacher except for those media that are being developed now for independent study by youngsters. The same film in the hand of one teacher doesn't function the same as in the hands of another teacher. But you can't point your finger at the medium and say that it has a potential danger or a positive feature. You have to assess this in relation to the person who is using it and the way that he is using it such as the vistas that he opens up for students or the degree to which he closes the particular medium. Some teachers I think are very much disposed to converging the discussion, to bringing things down to a point and focusing it and closing it off. Others are much more inclined, with the same instrument, to keep things open, fluid, and for interchange of ideas. I think we might put a stamp on this latter use as though it were creative teaching. And I will make a point on this later with some illustrations from films which I will show, wherein the same film in the hands of two teachers brings about quite different end products. I don't think, therefore, that we should in a sense label the medium, the instructional media, a the potential danger, or the culprit in the instructional situation. We have to look at the relationship and at the personality characteristics of the teacher who is using this particular instructional device.

Parnes: Would you say that the situation is one involving extremes in which one teacher does one thing and another teacher does another thing with the same instructional materials but between these extremes there is a very general kind of pattern that most teachers follow when using such media?

Beck: I am sure that there is a good deal of conformity in the way that teachers behave in a classroom and that they have been trained to use films in a particular way so that the person who is extremely resourceful in the use of the film is the exceptional one in the classroom. Likewise, the one that closes off the discussion following the use of a film, or uses it poorly, is exceptional. But this doesn't mean that it isn't possible to get much more out of a film with more teachers than we are now.

Parnes: Right, but perhaps part of the problem is that when people look upon the new media, they ask, "How is it used?" rather than "How might it be used?"

Beck: This fits right in with what Taylor said in the beginning that we have new media and then we tend to impose traditional teaching practices on those media. And this is where I think we are getting into trouble. So I would like to make a plea here for the freeing of new media as well as the freeing of teachers.

Torrance: Yes, putting things into the media that make it more likeable and usable.

Hughes: In discussing the media though you admit that a very large number of films that are now on the market cannot be used creatively. I know from my special field of child development, I am able to use only a few of the films that are listed in the catalog because they almost pyramid whatever is happening too quickly. Their concepts are incomplete or erroneous. It is impossible to use some of the media. I just use from four or sometimes five or six films but I just won't use any more because they just haven't any content.

Beck: It would seem to me that this would be one of the outcomes from this conference. It would be most helpful if we could give some direction to the film makers. And they need it badly because they reflect the tradition, too. They reflect a tremendous amount of orthodox thinking.

Hughes: Yes, but remember that there are many classes in child development throughout the country that use fifteen, twenty, thirty films. I am saying out of them thatonly four or five or maybe six are worth using.

Guilford: I think we need to remember too that we have people who serve a watch dog function with respect to textbooks. They also serve a watch dog function with respect to teaching media.

Torrance: And don't forget the textbook editor in there, too.

Taylor: Certain media, such as TV and teaching machines, as typically programmed, may have little positive effect and possibly some negative effects on the creativity of students. One danger is that of producing single views, single structures, single approaches in the minds and experiences of students.

Edling: That's the thing that I get an association with, the number. A single medium or a single message from a medium is not the usual case. It reminds me of the story of those little first graders that were out on the yard and an airplane flew over and they started talking about it, about the afterburners, and the thrust and all this business and the bell rang and the kids said: "Now we have got to go in and talk about Dick and Jane again." They got the experience of the afterburners and the jet and the angle of climb and thrust and all this business from your sentence. It seems to me that certain media such as TV and teaching machines as typically programmed may have varied positive effects. With at least equal impact, you could write it the other way, dealing with multiple effects.

Provus: Certainly, the effect depends on the teacher. We seem to agree with that. But I would like to ask a question of Paul Torrance. Have you found that as you have tried to develop new materials or new media specifically aimed at emphasizing a process that you feel is creative, that perhaps you should even try to help teachers see the process with the student through the media? Have you found that you still can't move about 80% of the teachers who use your material no matter what you put in front of them, because they insist on stereotype student behavior no matter what.

Torrance: No, I think the percentage would be the otherway. Probably about 80% respond and use it as a part of their own growth. But there are some who with the audio tapes, for example, wouldn't do much more than just turn on the tape recorder and go out of the room or stand by and that's as far as some of them go.

Provus: I didn't mean an inactive teacher. I am thinking of a very directive teacher. A very possessive, active teacher takes the media and uses it, but in the wrong way.

Taylor: You must have a situation where you need to help the teachers feel they have the "coach's permission," so to speak.

Torrance: One of the things that we did with the audio tapes is provide rather elaborate teacher guides that gave many possible ways in which they could be used. Even some of the teachers who were very negative to the material at the beginnnng went ahead and gave it a whirl and became educated in the process, it seemed to me from the reports that they wrote of their own reactions and that of their pupils as time went on. But there were some who held their initial conviction that the materials were no good. But the latter were quite a minority. There were tremendous individual differences, enough to indicate that the teacher is a powerful force in this business. But certainly it is important to have in the materials things that teachers could use to make it possible to increase the chances that creative behaviors will take place.

Williams: One of the dangers we might reach though in our design of new media for evoking creativity is what Beck was talking about. Assume we design a film with spliced questions or pauses and with instructions that here is where we should think divergently and so forth. Is a teacher going to use it this way? Or is she going to take it now and try to improve upon it by her knowledge of what the creative process is? It may involve teacher in-service training about what creativity is and how to use new media for this purpose.

In our extensive review of audiovisual teaching we found that most of the new media research in the past ten or twelve years has been involved in how the teachers either may use or do use a device, not how the film producer can create this thing for some type of classroom use.

Torrance: Yes, I have been amazed at how many teachers use materials creatively. It happens more frequently among those who get interested in using the material voluntarily than it does in the experimental situation where you draw them at random. They show flexibility and think of some really brilliant ideas for using the material quite differently from any of the many suggestions we had given. And I think, and this may be a bit presumptious on my part, that a lot of it came because the materials provided them a kind of in-service opportunities to become educated. Our tapes on great moments of scientific and geographical discovery, in which we were trying to communicate to children something about the nature and value of the creative process, it was our feeling that the teachers learned something from that themselves as well as from our own discussions about the rationale for doing some of the things that had been suggested.

Taylor: They should study these tapes first like they read the text first before they present them to the students.

Torrance: Yes, and in the manual, we did have a typed script of the tape which they could have read.

Mooney: This is a kind of a principle where the students are freed when the teachers are. And there is more chance of the teachers to be freed if the content (such as your moments of discovery) itself reveals a freeing of Columbus, or whatever. So that if you have a target which is itself freeing, you have a teacher also coming onto a target of freeing.

The students have a chance to catch this target both in content and in their own experience.

Williams: Some years ago I think we experienced the teacher guide vs. the classroom students workbook and these were written a little differently. I wonder if we may be getting into this area in the design of new media. We might have a new media device for teacher training on creativity versus a classroom student device. They may be entirely different.

Rogers: It might be relevant to some of this discussion that the mind set of the person doing the teaching is so important. One of the leading physicists at the California Institute of Technology has been very much involved in trying to free up their teaching of physics and even wrote a new text for their beginning courses and so forth. And he purposely put in, in addition to the rather standard material, lots of little peripheral issues, puzzles that no one knows the answer to, to get the students thinking about them. He was telling me that now he finds there is a strong tendency on the part of the graduate assistant who teach the quiz sections to include quiz questions on these peripheral things that he just put into stimulate and let people feel that this was still a wide open field and that there are a lot of unanswered questions. So now you have to know what these puzzles are and what the thinking has been on them.

Taylor: There are both known and unknowns in a field. We must learn somehow to give attention in the classroom to the unknowns as well as to the knowns even though this has hardly ever been done to date.

Hughes: I think I should put one of my biases on the table in terms of beliefs about teaching. One of the things about which I am convinced is that teachers will have to acquire new concepts of their jobs and new concepts of their relationship to students in order to eventually do any of these things.

If you took this course in which we used biographical sketches you'd find it was all right to act certain ways in terms of using biographies, but it would be wrong to act the same way in an arithmetic class or some other class. One of the things that research shows is that, in general, teachers behave very much the same in all American classrooms. The current concept of what a teacher does is much more similar than dissimilar. Many of the personality factors that have been investigated do not show a relationship to teaching pattern--they just show teachers working under a cultural, societal defined set of expectations. So there is a rule for most classroom teachers for what children ought to be and what you ought to do as a teacher. Now in some way, no matter what media are used, the basic concepts of the role of the teacher will have to be reevaluated or restated.

Beck: Does this suggest to you that maybe we train teachers according to a pat formula and then we put them into cells where they operate for the rest of their lives with practically no feed-back?

Hughes: Yes, there is very little feed-back as long as they keep control of the classroom--as long as the classroom doesn't go to pot.

Beck: Then they have no opportunity to watch others teach. Each one is in his little cell working alone and working according to the ways that he or she has been taught.

Hughes: I would even go further than that. I would say that our teacher training has practically no effect on what they do in the classroom. What teachers do in the classroom emerges from the concept that they have gotten as a teacher and they have gotten this through the years that they have been in school under teachers plus the cultural stereotypes and cliches and so on, rather than through the teacher training that they have obtained in colleges and universities. I think our training as presently set up has practically no effect. It may give them a little more confidence that they can face youngsters, but I think it has no particular effect in terms of their behavior.

MacKinnon: Are you suggesting that as they teach, they do something quite different than what they have been taught to do?

Hughes: Yes. Indeed they do something quite different than what they have been taught. But you see education or instructors in education, educational psychologists and so on teach as they have been taught, too, but they teach that people should teach in a different way than they themselves teach.

Guilford: They use their teachers as models.

Hughes: Yes, and they are responding to the models.

Rogers: One thing makes this even more difficult. At Wisconsin we tried an experimental program where we really taught the teachers quite differently, where they gained quite a different kind of experience than normal teaching. We followed that program but the data still are not clear on this thing, it is very tentative. Many of them I know from personal accounts found that the kind of teacher they had learned to be in this situation couldn't live in the educational sub-culture. So that they did drop it and simply become a conventional teacher because there was no place for them.

Taylor: That's the same as for executive development programs. You deliberately take executives out of their work situation and train them. But when you put them back into the old situation, the old system overpowers them.

Edling: I'd like to suggest however, the same idea in a different context. It is reasonable to expect that teachers should act and should teach the way they have been taught because the system has essentially the same ingredients that it has had in the past, the same kinds of books, the chalk board, and the same students in the same place and all. But what I think is unique about new media is that we are introducing something new into the system and it makes possible what you're talking about, this new kind of a role for a teacher, provided of course that this media comes in sufficient quantities to be not just something peripheral off in the corner, but can be a significant new element in the entire system.

Parnes: THis is relevant and I am thinking of a situation at our institute that relates to this idea that new media might provide a new opportunity for teachers who might not be willing otherwise to change. This happened to several people but one man particularly came through our three-day program where we taught our methodologies of creative problem solving and then we have a follow-up two-day program where they then teach a novice student the same concepts as a means not really of learning to become a teacher of creative problem solving, but to make it part of themselves. This one man's comment was that at the end of the first three days he didn't think that the whole business was worth a darn. He didn't see anything in it. But he said then when he observed what happened to the students when he taught this to them, it opened up his eyes completely to this approach. I think the new media might tend to help the teacher do this. If we can build some creativity development techniques into the new media and the teacher sees the effect of these on the students, then it might open her eyes to what she might be able to do here. As a matter of fact, this particular man then went ahead and developed and changed. Furthermore, he even changed what we were doing into his own version of it. Now he is writing his own program and having very effective results with it.

Williams: What you are saying is what we have been experiencing in film learning for a number of years. It is not the passiveness of the observer when he observes someone else teach by new approaches but the activeness of the person himself when he took over to do this teaching.

Parnes: Yes, but it wasn't so much his active participation in presenting the concepts, as it was his observation of what was happening to the students when they were learning it. Initially he didn't think there was anything to the methods, even when he had been actively involved in learning them; but the final two days he reevaluated when he saw that something happened in the students.

Williams: One couldn't see this on television when you were teaching in your demonstration.

Parnes: No, that's right. But I am talking about the total process, where he actually got involved in coaching students herself, and saw their reactions.

Williams: In designing new media devices, then the point may be how to get the classroom student, or even the teacher himself active in doing this in observing what happens to students rather than passively showing a film. This is a learning device.

Hughes: I'd like to ask a question here: "What experience did this man have that made him sensitive or allowed him to be sensitive to the reaction of students?" Because this is one of the things in which our teachers are generally not sensitive. They are so governed by the stereotype and so sure of their own role--and maybe one has to be to face 30 or more students everyday. But they are so sure of it that they do not assess the consequences out there in students. And so I am interested in how he becomes aware of the consequences and the student.

Torrance: That gives me another idea about our experience that maybe what we have but into the experiment of having the teachers write their own reactions and observations of the pupils' reactions might have been as powerful as anything we did.

Hughes: This is a sensitizing process.

Taylor: I wanted to bring in another angle. Many of us come from an area in which we are well versed and spend a lot of our time in what we call measurement or testing. In this type of situation we think of the test as not just a paper and pencil or ink blot test or something, but we think of it as the whole situation which includes the examiner who is in a way analogous to a teacher. And we see to it that we do all we can through instructions to examiners to insure that the examiner is standard from one situation to another and does not vary. So we give some very deliberate training to these people and have some tests designed so that the examiner does not come into it much or in other cases where he does, but he comes into it in a very systematic standardized way so he is not one of the sources of variance in it.

Now recently I visited a Catholic University and they said that they had in turn a civilian and a priest in his traditional garb administer a true-false test. And they got more honest answers when the Catholic priest was up there administering the test. (Laughter) As a joke, I asked if that meant that the students responded with more true answers in the true-false test, but they restated that they got more honest answers. There was still some variance across examiners and this nearly always troubles us in measurement. In trying to translate from our measurement experience into the classroom situations, one might see that the teacher might add distortion to this process of trying to get these new kinds of behaviors inserted in the classroom. So from this perspective if the teacher doesn't perform in certain ways, then we are losing ground or we are getting distortion, which ever you want to call it. What we intended to get was different kinds of behaviors and experiences. And alternatively then, do you want the teacher variable though to be a free reigning variable or do you want special teacher training to occur just like we have trained examiners, sometimes for a long time, before they can give certain kinds of tests? And I understand some clinicians feel that only when they are real good can they then vary some of the instructions and thereby even try to improve upon the measuring process through their masterful artistry.

Beittel: It seems to me that we have been thinking in terms here of the existing classroom. We limit our thinking dangerously because, to take a far out view, there may be no reason to bring 30 people together for classroom learning. And it might be stupidity to continue such a thing, for when we have new media available, other arrangements are quite possible. The field I come from has never quite dealt with group action, it has been more or less individual action. I think it gets more so as I study it more and more. The type of thing that Carl

Rogers is talking about, the intensive group interaction, which is where attitudes and where personalities are affected, is not within the traditional context of the classroom. I think the whole thing is a formality which is essentially meaningless, taking an outlandish view of the whole business, and that media gives us a chance to explore other arrangements. I remember hearing a man from IBM saying his viewpoint was that the logistics of education in the past required us to get people together and share a teacher. Now we have funds and different logistics. We are not required to do this and if we have good reason to do this it is because one to thirty people need to share the same symbols. If you look at that honestly there are very few times perhaps when this is necessary.

Taylor: You remind me of two thoughts. Traditional school buildings have been described as egg cartons. They are all of thirty student size and they are just like an egg carton design. Then I heard of another report that went like this. A large school system got its teachers together and had them think of all the things they could do at least as well or better in a class larger than 30 (beyond a certain number and for most purposes the number of students reaches infinity like on a camera). The teachers listed a whole flock of things. And then they were asked to list all the things they could do at least as well or better with a class of less than thirty. And they listed a lot of other things. The last question asked was what is left over? And there was nothing--nothing left over that was particularly peculiar to a classroom size of 30, nothing that could be done best of all with a class of 30--and yet that's about the size of a classroom designed into all of our well constructed permanent classrooms.

Edling: I want to read as an example of the kind of thing you are talking about here. It relates to an earlier point that the students are freed when the teachers are. At one of the dental schools they have been teaching a dental anatomy for years and years by a man getting up to the chalk board and drawing an outline of the tooth and naming the surfaces and the valleys and drawing outlines of this entire matter. The students copy it down and then after so many hours of this type of learning, they take an exam and they go into the lab and start carving these teeth, etc. This has been going on ever since the dental school was organized. And we worked with this dentist, the professor, and programmed the first 12 hours of his first 12 lectures in this area and he used it a year ago and this is what he found. We found first of all in programming this thing that the material he gave us contained many errors. He had been putting his information out but when he saw it come back in the program form he picked up some of these errors that he had actually been teaching from his notes. The results of programming showed that mean time for students to acquire the same information was only 4 hours and 10 minutes which originally took 12 hours. So there is about a 66% saving of the students' time. He did not have to do anything, so there was a hundred percent savings in his time, from prior years. The mean scores of students were ten points higher on the same exam than he had been giving all these many years on this topic and it was the first time that any students had ever received perfect scores on his tests. No student had ever received a hundred in this exam before. This was fine except that we found even though it wasn't a particularly good programming job. Students gotinto blocked-in routines and if this program were really sharpened up and perfected it probably would show greater efficiency and an even greater economy of time. But the real payoff was the eventual saving of the professor's time that he said now gave him more time to work with individual students because he didn't have to do anything else. The students took this material, took the exam, went in and carved their teeth, and now he had time to check each student's carvings individually. He spent all his time in the lab with individual students. And this then permitted him to find himself a new role now of working with individuals and criticizing individual work.

Provus: I don't mean to be facetious but do you know what this sounds like to me? A Hopi Indian medicine man knows how to make a rain dance. And he programs and teaches others how to make the rain dance in four hours instead of eight and he finds out he wasn't doing some of the ritual right anyway, and now he can have them do rain dances in four hours and maybe even get to the point where he will get them to be done in two.

Edling: I don't quite see the parallel.

Rogers: Who knows whether what he is teaching is at all the best way to start off dental students. What I wanted to ask was the program changed so that they started dealing with real teeth rather than starting with pictures?

Edling: The point is they have defined the kinds of behaviors they want. They had in mind identifying a standard nomenclature for the use of the teeth. This is used by everyone, technicians, dentists, and everyone. They want the person to be able to form teeth in a certain way, and through this method, the evidence that they have at the moment is that they can achieve the kind of behaviors that they had originally set out to achieve more effectively. Whatever behaviors were in mind, they are achieving them in less time.

Edling: Now you are raising the additional question of whether the dental trainees should achieve these kinds of behaviors? This is a decision that is a philosophical one, one that they have already made. They want people to use this kind of nomenclature on the teeth. They want people to be able to communicate with each other about the surface of the teeth and as a methodologist I am not going to question their objectives. That is for them to decide.

Taylor: I would only say that these discussants were opening the question larger. This is essentially what they were doing. Our research on physicians in practice indicates that the questions of the what and how and why of medical education ought to be opened very wide because we are finding little or no relationship between what happens to a person in medical school and his later degree of success as a physician. We can't find anything that happened to him in school that later predicts anything that happened to him afterwards as a professional worker. We have given pre-med grades usually the main basis (on which medical students were selected) and their first two-year med-grades and their last two year med-grade a total of 800 chances to show a correlation with later professional performance and in only 3% of the cases have the correlations been non-zero. And two percent of those significant correlations were negative.

Edling: The same thing has been going on in dental education. They are trying to determine what are the correlates between any kind of external criterion for success. Apparently certain kinds of sociological factors--ability to get along with people and most of the criteria they are using--are effective and so they have wanted to introduce courses in dental sociology and psychology of practice and this kind of thing, but they have so many required hours of instruction now that they can't introduce these new courses.

Taylor: Yes, this is the wide open question of the old system versus a potentially new system, a fresh start.

Edling: This is the point then. With the time dental educators saved in doing and achieving the current given objectives, they now introduce programmed materials to teach these additional courses to get at the very essence of practice where they have not had the opportunity previously to get them in the curriculum.

Hughes: They haven't yet asked the question whether we need all the stuff they presently have in the curriculum.

Edling: They have had a study of this and they feel that they need to have this nomenclature on the teeth and they have answered the question that they do have to have people demonstrate this kind of behavior. But they have a lot of other things besides.

Provus: Doesn't the methodologist have to ask the philosophical question? Don't people at a conference like this who are trying to find ways to change media have to talk about the why as well as the how. Isn't that the very heart of the problem here? We probably can't ask these questions at the same time but we have to find a way to do so if we are going to talk about process, because process is the how and the why combined.

Edling: I disagree with this completely. I think that at every conference that wants to start talking about objectives, they get into a sub-discussion and we have to make one of the givens at the conference that we realize that there are cerain kinds of behaviors, in this case creativity, which is yet undefined. But this is the kind of behavior that we want students to engage in. Now the question is not whether or not we want to talk about creativity. That is a given. Our discussion now, it seems to me should concentrate on how the media can be employed to reach this kind of objective, not whether or not we should strive for this objective. This may be a good and honest and useful point to discuss, but I think that it is not prevalent here.

Guilford: I'd like to raise the question of whether we really know what we need to teach in the way of creative behavior?

Edling: I think that if we get into that, that will be the end of our talking about new media. You have to assume that you know whatever this thing is, that you people have spent ten or fifteen years working on. At this conference, we are going to assume that you have identified something and now we are going to see how to apply it and bring it about.

Parnes: Isn't it all relative anyway? The improvements we make are never going to be the ultimate. If we make a start in some direction, it may not be the best, but this is implied in the whole notion of creativity.

Taylor: It is better than not having made this start.

Parnes: Yes. I don't think that we are going to create the ideal, because as soon as we do, there will be another ideal.

Hughes: It will only be the best that we know, the best that a group like this can do at present.

Parnes: Within the limitations of the time allowed, the energy here, and so on, and then someone can move on to the next plateau. I don't see how else anyone can do it.

Beittel: Unhappily, you do have to deal with the whole aspect of the system and in the case of the dentistry school, eventually the objectives would come into play. We never even talked about what that professor was really doing when he went around to individuals. I would like to know that. We can't let the discussion go entirely into instructional media and still be able to describe the variance to teachers. We don't know what teachers are doing. One difficulty we have after we begin to describe a kind of a program setting in the studies I have been involved in is we don't know how to use teachers creatively and they don't know how to use themselves to correct their behavior. And these are all aspects of the same system as I see it: as objectives, methodologies we use, and the media--all these things wind up together.

Hughes: Our records show that when teachers are doing individualized reading, that in their conferences with students they behave the same as though they were teaching group reading with 12 or 15. I can blind my typed scripts and give them to you and you won't be able, until you are way through with it practically, to tell whether the teacher was working with a group or working with an individual. Now this is very sad.

Mooney: How about a kind of a principle of this sort? Since media are an innovation, the introduction of media offers a chance to raise the whole questions of what innovations are needed. In other words, as you moved into this dental situation, this professor had a new set of questions to ask about himself and about his teaching. In the stream of that realization, he probably had a more open mind for raising further questions than he would have had prior to this event. You use the new media as an innovative means to excite an invitation to create fresh ways all the way around or wherever it may be needed. So that maybe you could get a benefit out of it that way.

Taylor: You can potentially open many more questions that were previously being treated as closed.

Mooney: You get the full impact from the little thing you try as it becomes enlarged.

Taylor: And so by inserting new instructional media into a curriculum each year and thereby getting some flexibility into your curriculum and your teachers, you could eventually get all of this in your whole system.

Mooney: If this were one of our tenets, one thing we would seek to do would be to surround the innovation of the media with an invitation to the growth of the questions it brings out for fresh thinking.

Taylor: So you do this partly if you have to train your teachers to use the new media and through the media you open up a lot of other new questions.

Provus: But the implications can go beyond the practical matter of training teachers. When you design innovation in the first place, you do it with the thought in mind that it will serve this added purpose of opening other doors.

Taylor: One often likes to be "in on the ground floor" because then you can build everything from scratch. But the systems are usually old and the gears and cogs are already in the system. When you try to change one of the gears you can raise the question what other gears can you change and how close can you become to being back on the ground floor, so that you can start things all over.

As stated earlier, if new instructional media can accomplish the same things more efficiently, some time would automatically be freed in the teaching program to focus upon creative and other thought processes largely ignored heretofore. Other instructional media, such as teachers, could then specialize in creativity and utilize TV and teaching machines on those things for which they prove to be most efficient in the total learning situation.

2

Yet, we as teachers may not know how (and will have to learn how) to do things which require and cultivate these creative and other thought processes in students.

Discussion-Recitation-Interaction Situations

In using instructional media to develop creativity, we could encourage various types of attention--not solely the type that slavishly follows the instructional output in the learning situation. We need to learn better how to produce stirred imaginations with their unique attentional features. We also need to recognize and develop certain kinds of performance observed in group discussion, wherein some help by setting the stage while others make crucial leaps ahead by not slavishly following the discussion. Instead, they think at "right angles" on an unusual train of thought (perhaps even turn off their listening for awhile), but **later** re-enter the discussion to send it down new, fresh routes. Recordings showed that one person did this several times, whereas others merely contributed minor variations or refinements around already existing themes. However, if a student replied in class that he didn't hear the question, one wonders whether he would be given the opportunity, without fear of reproach, to express his thinking in case it was on the problem although along different lines than expected?

Many settings and materials could be designed to encourage students to think up multiple alternatives to problems of the type where any of several solutions might be quite successful.

We should encourage students to think of their own and to be both able and willing to toss their ideas into the arena of ideas. We should also aid them in learning what the consequences may be, by somehow letting them experience typical group reactions to new ideas, including possible strong tendencies in others to close their minds to these new ideas or to react with hostility toward the ideas and toward their originator. We need to help them to live successfully through any such consequences. Too often we may discourage this idea-producing behavior through much of our school program and then later suddenly switch the "nature of the ball game" to encourage some of it in graduate school. Partly for education purposes, research is needed to learn the details about how evaluation and decision making can effect the birth and survival and also the death and even the resurrection of new ideas.

For the sake of creativity, we could indicate to students how some persons have been more encouraging to new ideas, have allowed others to be more creative, and have suspended their judgments about new developments rather than feeling that they must give an immediate judgment--which too often might prove to be a negative one. In other words, students should learn that a judgment of a truly new idea, based on present-day, common-sense notions, might tend to be negative, since one feature of the new idea will be its uniqueness rather than commonness as seen from the "current common-sense" framework.

Various classroom situations, teachers, fellow students, and other instructional media should be studied to see to what degree they "program" or "fence in" students, thereby continually reducing their chances of being creative. We should discover what current features have the effect of building in restrictions, inhibitions, and various other forms of deterrants which hinder or block the possibility of generating fresh solutions in problem areas. These built-in restrictions, whether self imposed or instructionally imposed, may reduce the freedom and potentiality of a person.

Fellow students can sometimes be the most powerful instructional media in influencing other students to learn or to fail to learn. Torrance found that students may devise many social controls over those showing creative characteristics. We, therefore, need to learn how to utilize the instructional media of fellow students to bring about positive in place of negative effects on the creativity of other students. And alternately, we should learn how other instructional media might be used to neutralize any negative effects by fellow students on the creativity of their classmates. A related question is how to use instructional media to develop effective questioning ability and other forms of curiosity in action. Stated conversely, we need to know how we can overcome environmental features in teachers, fellow students, etc., which tend to suppress, curtail, or otherwise stamp out questioning and other curiosity behaviors. We need to learn how to prevent unnecessary rules and needless restrictions from being built into our organizations and into our students which bring about any unfortunate narrowing down of potentialities.

Another challenge is to use instructional media to develop creative reception as well as creative expression in students. How can we teach students to listen creatively, to read creatively, as well as to write and to speak creatively?

Instructional materials could be developed to have students practice in manipulating, organizing, and increasing the number of ideas dealt with at one time. Perhaps an increased flow of ideas in all students can be brought about by requiring them to manipulate things in their hands. An increase in ideas and discussion about a topic will probably occur among students after having a rich, active experience pertaining to that topic.

Beck: Where you say we can design media to help the individual in this regard, I come back to the point that it depends upon how a particular medium is used, in what relationship it is used.

Taylor: And really what you are saying is that part of the medium is the person that uses it.

Beck: That's right. He is attached very closely to it and he can influence the quality and effectiveness of this particular message that is built into it.

Beittel: But the use of medium is not necessarily his personality. We have a visiting professor with us at Pennsylvania and I watched him very effectively give a demonstration with a group of sophisticated graduate students on now to create two different climates. I think that the reason he succeeded so well was that he had the constructs in mind as to how he was identifying climate. He put them on the board. He used visual aides, very clearly, for his objectives in ths whole experimental session. He randomized these people into two groups and sent them out. I am giving this in a little detail because I think it is relevant to the use of instructional media for sensing how we build feedback into instruction, to correct our behavior. And after randomizing these people he brought them back in one group at a time and by rapid verbalization, shaming, and other devices, which seemed quite normal in classroom behavior, proceeded to have the students feel what it was like to go through these, so that their own thinking felt constricted, and so forth. Now, I guess what I am saying is that demonstration and the use of instructional media to get across these feelings are quite conceivable.

Mooney: Isn't there a point here of using the media effectively?

A while ago we were talking about the introduction of instructional media as an opprotunity to raise questions about innovation in the school system or innovation in practice or in thinking about the system. And there seems to be a correlate to use the media as opportunities to get the teachers involved in becoming creative, in the forming of something fresh through the medium so that they can find themselves revealed before their own eyes by having had the chance to create and to sense the experience. Maybe there is too much of a tendency to think of media as packaged products that you can mail around instead of thinking of them as providing an opportunity to engage people in creation through this medium. In art we speak of the medium for the painter as the paint and his canvas. In education maybe we ought to think of media as being similarly used, as the means through which creation occurs.

Torrance: Media can also be used to help the teacher to warm up.

Mooney: And as she gets a fresh mode of forming her experience, a fresh mode of expression to become intrigued more than she otherwise might with the notion of giving students fresh ways to form their experience so they may come to some self revelation of what they are doing and continue such processes into their life.

Beck: I think that is a very sound area that we need to work through at this confernce. It is the very important use of the medium as I see it. There is also a relatively new development which is intriguing, namely the design of media for individual student use and independent study apart from the teacher. Programmed instuction is perhaps the best example of that but we are getting it also with single concept films, individual student viewing, and the like. So here is another large area to think about. My own disposition is that I am intrigued by what you have to offer of what we can do to assist this teacher to be more creative in her relationships with children.

Rogers: One footnote to several of these things that have been said here which touches on a favorite bias of mine.--we have for so long paid too little attention to what I think of as experiential learning or learning as a whole person. In this area of helping teachers promote creativity as long as it is simply an idea up here, I am not at all sure how much will come of it. However, when some of the aspects of it are really experienced in a gut level fashion, then I think these people really experience what it is meant by being inhibited in a classroom by just some very ordinary remarks on the part of the teacher. It is then going to be quite a little more difficult for teachers to do that to the next groups with which they deal. But you could give some pretty good lectures on it and it wouldn't sink in at all.

Williams: We have found there is too much embellishment built in a media device. Just a simple thing may serve such as the play-back or the feed-back of the tape recorder to hear your own voice, your own biases on there. If we look at designed media for teacher use, I think we ought to take out embellishments and make them simple.

Taylor: One type of contribution is to be a creative teacher or administrator by developing an atmosphere very favorable to the creativity of others. Maybe teachers and students can learn to serve as catalysts or to spark and provoke new ideas in others, rather than being new-idea men themselves. Through appropriate instructional aids, perhaps students can also learn how to have other people interact with them to spark themselves to new ideas of their own.

Parnes: Does it sound reasonable to you media specialists to talk about students' inner-resources as mental libraries, as I like to call them, as a kind of instructional medium in themselves. In other words, one of the things we are trying to do in creativity development is to get the student and also the teacher to understand how to work with the student's own medium of his mental library. This comes close to what you are talking about in terms of this spark plug concept because we can think of this mental library from the standpoint of filling it up a little more like a gas tank and mixing it up a little bit more, too. Or we can also think of it from a standpoint of how we can trigger it off a little more.

Taylor: And other human beings may be a better source for some than any other kind of thing that they could go to to trigger it off, but for others books or films may serve best.

Edling: People who are now teaching listening skills have as one of their points something almost the antithesis of this thought. And that is that if you are going to listen effectively, one of the things you need to do is to turn off your whatever you call it, your own internal library. According to them, instead of going off on your own thoughts when this thing is triggered you should be able to cut off your internal library and stay with this person to more or less fill up the new book of information he is providing.

Taylor: He is the authority.

Edling: Yes. This is what the listening experts teach you.

Taylor: They suggest that you are nothing and everything is here on the page of the text or is being dished out by an authority and all you are supposed to do is to slavishly follow and record this input information, without having any thoughts of your own about any of it.

MacKinnon: There are various ways to condition any kind of creative response. Unless you get some kind of associative bond between what is coming in and what is already there, you are going to have information as isolated unstructured knowledge. On every single bit of information that you put in, you can only do this if you have a certain kind of mental set or mental orientation, so that immediately when an item is put into your mind, it gets associated with many other items that are already connected in a net and if you don't do that, you are going to lose it very quickly, it seems.

Taylor: What you are saying is that you would get separate tapes internally.

MacKinnon: Like the old Freud and Broia idea that repression results from a lack of associatve elaboration. Because a particular item put in the mind did not get associated with other items already there, so it therefore is lost.

Torrance: Some listening experts on our campus take a quite different viewpoint. They would even recommend trying to guess what the speaker is going to say next. And a lot of other devices like that.

Taylor: Brewster Ghiselin recommends to skim in listening--you have to have some affective technique to do this. It means you may not think that what is being said is worth your full-time listening. And then when you want to fill in the gaps, you have to say, "Well, I wasn't sure I got this point from here to there." But if skimming is not done with finesse, you may estrange all your friends. They will no longer talk to you because they know you don't listen full time.

Rogers: This can be a subtle thing too because I feel as though anything I have learned about personality, I have learned from listening to people and really trying to shut out too many pre-conceived notions through forming the associations later, letting them come in later. I feel sympathy to both sides of this argument because it seems to me if you are really listening to something new, and I feel that the life experience of another person is a new thing, you really don't get it unless you do listen to it from him and catch it the way he means it. But then to be sure, you link it up with all the hundreds of other things you have heard, too, to make sense out of your total experience.

Mooney: Don't you have to listen to him as if you were trying to comprehend the system saying it, the system composing it. And in order to be able to do that, you will have had prior to that the need to experience yourself as a system expressing itself. So that there is enough sort of realized objectivity about one's own operation of expressing himself as this man undertakes. That this sense of system with oneself, of having a mind that operates so that you can listen to the other man composing this way. So there is a sense in which the person listening has to have, what shall I say, he is in there all right but he is in there in a kind of a sort of an objectified way. But if he has not had the chance yet to inherit this knowing about himself, he won't be able to listen with objectivity to the other person.

Rogers: One other aspect of it too, I think, and that is that you listen realistically. For instance, don't listen to another person as if what he is saying is an authoritative statement of what is true of all people. It is an authoritative statement of what is true for this one person and that way it can be taken in and really used in more general things.

Guilford: This reminds me of Einstein's saying that he sometimes denied that he knew anything about something that was very obvious in order that he might get a new look at it.

MacKinnon: But if you are reading a book, do you read a book all the way through with your blinders on so that you listen only to what this author says? I suspect that you don't.

Taylor: There is an occasional system that wants this kind of performance. Isn't that the crucial difference?

MacKinnon: I suspect you would get much more out of a book if in reading along, you get so excited about it that you have got to write something down, over in the margin, or develop some other approach. The danger, of course, is that you get terribly confused because some very creative individuals that I can think of really never know what the author has said and what they are thinking because they do this so actively. On the other hand they are quite creative individuals.

Taylor: I believe Emerson said that the book has served its purpose when you get a better idea from it than the book gave you, and set the book aside to pursue your own new idea.

Provus: The point that confuses psychologists is that he can't tell someone where he got his great idea from. So what. He made use of what he wanted. The idea of training listening is somehow so foreign to me to the idea of teaching. I can't even conceive of the separation of listening, somehow apart from a total self-directed process.

Rogers: But when a person is talking about his own life, he knows more about that than I or anyone else knows and consequently he is worth listening to. When I read a book it is usually in the general domain of ideas, and I may know as much as the author does or I am sure that there are other people who know pretty near as much so that the reader can be looking at it rather critically all along. The thing which you don't look at in that way is the poem, or the very personal expression. If you are going to get anything out of it, you had better try to experience it as the person experienced it when he wrote it.

Beittel: Listening and looking at art, especially in the art of people not trained in art is precisely like this. You can't tell what it is without a program or a speech. You have to be really open to what that person is doing. He is working with what I call "inside-the-head junk." And inside the life-junk is really his whole system, his whole background. This comes out through this funnel of a medium which is very very hard on him really, especially when he has no background in the arts, But what counts here is precisely this personal stuff. As a teacher I can't see how this type of listening, or this type of looking which is completely open, are disfashioned. I think that in a sense MacKinnon was talking about that, too.

Edling: This is another large category that can be discussed. There is also research on it. Robert Mager has devised a capsule where the learner has complete control. He can raise the temperature, the ambient noise level, the light level, and the information coming in. He has two-way television and all sorts of things. One thing that Mager has found is that when a person asks for information, he will want to know something and so it will come in by television.

At about the time that the transmitter supplying the information is about to make his point, the person will turn him off, because he has the information or he has the cues or it has triggered off some thought. The important thing in this category and the principle involved if we are going to use media to stir creative behavior in children, is that the learner should have some kind of control over the media which he can't have with a teacher because when he turns off his mind the teacher goes on and continues to supply information at least whether it comes to him or not. Even if it doesn't come to him, the teacher continues to lecture.

Provus: That's a lecture teacher who is lecturing.

Edling: Yes. This is what most teachers are. When the information is coming from some other information source, the learner, at least with certain media learner's can pursue that association, can do divergent thinking, and so forth. And the media then can be paused and held up.

Hughes: Don't you think the dimension of validation of communication some place along the line is important here? Isn't this interwoven here? There are times in face to face intercourse when you want to test for understanding. You want to validate the information; in fact Davis and Shepard, have a very fine essay in which they claim that the intergroup experience is largely that of validation the communication.

Taylor: What I think is being said in a broad sense is that we do teach for reading. I don't think we teach all kinds of reading. And we also don't teach for listening. Though we do because students sit in a classroom so much of their lives that indirectly you are letting students learn it. What we don't teach are all the skills or different processes or the variety of types of listening and reading. Like you say, if the teacher keeps on going, so that they learn to pluck off what they want and then turn back in again and pluck off and so on and do the best they can under all the circumstances.

by having different techniques or different gearshifts or such and take their chances as to which ones they are going to play. Where as if they don't have training in this and don't know these, they may be using some and feel guilty because they have no stamp of approval. This may be just the kind of thing they need after they get out of education but not in education the way it is often conducted. But we do need a lot of techniques here. I think students ought to know when to slavishly listen and to openly listen and have a clear slate. And I think they ought to know when they should skim and when they shouldn't and when they got sparked to new ideas and they go off on that and say well, the teacher isn't doing as much as I am doing when I go off on this new idea. I think they ought to have some experience like that.

Provus: I certainly agree with much of that. The only thing I would fear would be that the teacher, in an effort to provide the students with these experiences, have therefore a need to control quite a bit of what produces this experience, may tend to overlook the child's innate ability to listen to what he chooses to listen to and to adapt the process to the mold. I think much of this is built in to the kids.

Taylor: If you for example, could think of doing it one day you maybe could teach him one hour and have some instructional media, be sure they have a certain kind of listening experience. And have another listening experience on another day. And reinforce their support for this kind of thing and so on. At the end of the day turn them loose and give them a variety of things and have them practice doing maybe what some of them were already doing quite well. But now they understand themselves more and they can do it a little more explicitly and. deliberately.

Torrance: We could go back to a booklet that Alfred Binet wrote in 1909, in which he said that children by the time they come to school will have developed certain ways of learning, manipulating, arranging things in different order, and experimenting and questioning, telling stories, and so forth. These were learning skills that they already had, that were well learned. That's how I would interpret what he was saying about what was built into the system. I think man does perfer to learn in creative ways when permitted to do so.

Parnes: If we take a typical lecturer with a kind of evaluation of the student based on the lecture then the student is forced to practice listening that is straight bucket-filling listening.

Taylor: And he realizes that this is the time when he has to play the game that way.

Parnes: But he doesn't get enough chances to play it any other way to really develop the other skills.

Taylor: Except if we build other approaches or new instructional media and install them in the classrooms or elsewhere. I want to underline these various kinds of listening. If we say that there are a great many ways to learn, including a great many ways to listen that need to be practiced, then we have to build into the school day more variety or more openness so the student can choose to practice these different listening and learning abilities in terms of his own interests, his own problems. Otherwise, he often doesn't really incorporate what we give him, except to regurgitate it again. And that may not stay with him very well or be very useful in terms of later transfer effects. This is the kind of recommendation we are making in our educational theory.

Beck: I am curious about the point Parnes raised earlier about this analogy working with the creative kids, drawing upon their own resources. Is this comparable to a bucket or something which you fill? How do you feel that analogy works with them? Do you think this is a good analogy of psychological process and creativity?

Parnes: Yes, I do. As a matter of fact, this is the kind of a thesis that I worked with in terms of our program. I am going to discuss with that later.

Provus: I am glad you asked the question because I misunderstood the point.

Parnes: I would have corrected the misunderstanding later anyway. A lecturer could say to the students: "Today I want you to listen to what I have to say and I am giving you an examination at the end, and the examination is going to ask you to give me every new idea that you can that was triggered by this lecture." Now this would call for a completely different listening set. And I wonder if something like this couldn't be useful?

Taylor: Sure. I've done this. I did this in our proseminar this year. Each day I had graduate students do some thinking assignment to be written up and turned in the next day. At the end of the quarter I asked them to deposite all the additional ideas they got during the quarter, all those they thought of since they turned in each of their assignments. That was a first example. I had also asked students to read the literature and to come back with new ideas of their own that they got, while reading the article such as marginal notes that they would write. Some students said they never read so much literature in their life trying to get a new idea of their own. One of them told me later that he got a new idea while he was listening in class so he said he had to go find a suitable article to which he could attach it to get credit on the assignment.

Another thing in the proseminar, I asked them to list all the things that we do not yet know in psychology. At the end of the class one student walked out of the room and asked another student "Was he implying that there are a lot of things that we do not yet know in psychology?" This said something about his past educational experiences. Later on the staff voted with the students that they ought to throw out my part of the proseminar because you see I was asking whether the students had research characteristics and creative characteristics and were interested in what was not known as well as what was known and so on. It was all so different from the usual classwork activities that both staff and students would throw this all out. It was too late in the game to be changing things at the roots--perhaps it was too threatening to all of them to try to be so much on target.

Edling: From looking at the typical classroom though, you were talking about this bucket-filling operation and I always think it is like the story of the psychiatrist where he says "Who listens?"

Taylor: In the world of work we have done research on communication ability. Most communication is by word of mouth, talking and listening. So there are times when you want to be a slavish listener and transmitter--that is, just an efficient tape recorder transmitter.

Provus: If you are interested in your work.

Taylor: You want to pass this word on to other people, as a middle man in a link system. If you want other people to have the information they need, you first receive it fully and accurately and then you transmit it likewise. You become a straightforward transmitter.

Williams: I want to reflect back to what was mentioned about new associations, new combinations of past bits of information. I think this is the crux of creative thinking. I would like to ask Carl Rogers when you take in information as you listen, then do you purposely give yourself a period of reflection to make these new associations or do you think this is unconsciously done?

Rogers: I guess I would have to say both, though I am not really sure. Certainly I begin to sense pattern, this is so common in me it is almost unconscious I suppose. I hear this particular person but as a result of that I begin to sense pattern that extends across many people. I think what is this process of association that really permits the seeing of generalizations or that I like to think of even better, the sensing of a hidden pattern that you couldn't as yet define clearly yourself but which you feel sure is there. I think this is the heart of creative thinking in any science, at least, though I am not sure about it in every field. I guess I would say that this occurs only partly at the conscious level. I think we don't trust ourselves enough at the level below cognition.

MacKinnon: I suspect there must be a great deal of activity going on in your mind when you are listening to people in the region that Harold Rugg called the transliminal mind. This anti-chamber of consciousness is off-conscious, not unconscious, but off-conscious.

Rogers: I am very sure of that from one parcel of research in which I participated which unfortunately was never completed. After a tape recorded interview by a therapist in a class interview situation random parts' of the session were played back immediately afterward to the class and to the therapist and they were asked what was going through their mind when this happened. This was really a revelation to me because I would have said before hand that nothing was going on in my mind except I was listening to the class.

But when I really opened myself to what was going on in my mind during any of those segments, all kinds of things were, but at sort of a transliminal level. This is a pretty good word for it because these were not completely unconscious thoughts and yet neither were they at all in the focus of awareness.

Taylor: And you were "listening" to a lot of things besides the words, too.

Mooney: Oh, yes, sure. In a therapy situation, one knows he is to give a client's life back to him. You do not include stuff from him, except as it is refocused on its way back. Doesn't the painter have this when he works? He has to sense what's forming on the canvas. Or when poets write, they have to sense what is forming in the poetry, or when scientists are operating as thinkers in their science at moments of creation, they have this sense of what's forming in the idea. The focus of attention, of consciousness, is to allow a further forming to take place at that time. And so the consciousness has to be free to feed that way. Consciousness is a way of arranging energy to move in that direction as best one can. Now when one is reading a book, the intent may not be to give the life of the author back to him, or to sense what is forming particularly in the book. Sometimes a book will get a hold of you and you say this is intriguing. I have to find what's forming there. Or you can use it in other ways, such as to fertilize the formings that you already sense and are trying to foster at this time in your own mind, so that the direction then is a little different.

Rogers: This is so relevant to one comment I want to make. When Taylor asked me to participate here, I read a lot of the material that he sent me and I didn't really have any criticisms. This material did set off some reactions, though, and one associative reaction I recall was what has been my own experience in doing the things that I regard as modestly creative that I have done, as each one of us could ask ourselves about these same things. Several elements entered into it. I think that the fact that I got strong complete training in a very statistical, hard-headed point of view at teacher's college at the same time that I was getting a very extreme Freudian training equally closed, equally certain, at the Institute for Child Guidance in their training period has always constituted a kind of a tension in me. I think this combination has had kind of a background aspect of moving towards something creative. More specifically in individual instances I have noticed that, unlike lots of people, this is my specific experience, I need time alone if I am going to be creative. I get lots of stimulus for it maybe in interaction but the time that I might really get to doing something creative is preceeded by time alone and time to let things gestate. This is why I believe creative thinking is only very partly conscious--a lot of it, I think, goes on unconsciously. Sometimes when I have thought I have just been on vacation, toward the end of that period I have discovered that this is the time when I have really been doing the best thinking, only I have not been sitting down and deliberately thinking about it.

Another extremely important thing to me is that if I am going to do anything creative, I have to have a real sense of no one looking over my shoulder. I acquire that most easily by actually getting away from people looking over my shoulder. I was talking the other day to a faculty member who says that everyone on their faculty is evaluated very carefully every two years. I can't think of anything that would be a better way of killing significant creativity. Everything you do you feel "how will this look to the reviewing committee?" I couldn't have an idea worth a nickel in that kind of a situation. I feel that we have to manufacture for ourselves or somehow obtain a time when we really feel that people are not looking over our shoulder.

Then one crazy thing for me, and I don't know how many people have this kind of a peculiarity, is that I have to create a situation where I feel that no importance attaches to what I do. I carry this to such extremes that if I am beginning to work on something that feels to me as if it might have some significance, I like to work on the back of old papers so that I don't even feel I'm wasting paper.* This is part of my Puritan up-bringing. At such times the writing down of bits that don't make sense and don't fit together is important. Here is a funny thought that came to me. O.K., I'll jot that down, or here is something else. I realize that in putting together things that have started in that way, those are the things often that I am most willing to stand by the longest, and I really feel O.K., that it has something to it. I guess that adds up the notion that anything creative has to kind of be teased out and permitted to emerge by the individual himself as well as by his environment. I sometimes have said we sorely need a course, in the care and nurture of infant ideas. And believe me, if we were trying to care for and nurture infant ideas, I feel certain, we would do it quite differently from any ordinary educational set-up.

Taylor: These infant ideas are the kinds of things I was trying to explore in our proseminar students who were well versed and well steeped in verification kind of scientific activity. But neither the students nor the staff wanted any of this stuff. They wanted to learn well documented stuff they could rely on with some authority behind it and that was it. They wanted to go back completely to all their habitual ways of doing things and did not want to deal with infant ideas of their own or of anyone else.

---

*Editor's note: Afterwards some of us decided not to throw away any scrap paper after we were through with it, but to send it to him as our small way of helping him ensure that his ideas will keep flowing abundantly.

Rogers: I don't suppose I will ever get over the shock that I got when Elden Hall did a very nice thing. He sent me the chapter on my work they were including in their text book before it was published. Well, that experience left me with the greatest depression I have known for a long time. I wasn't misquoted. What he said seemed reasonably accurate, taken sentence by sentence. The only thing was that something which was open and uncertain and tentative and maybe it might be this way, all of a sudden was crystalized to: "Now Rogers thinks so." And the closure, the effect of realizing that things are put out and then suddenly become all closed, was just a horrifying thought that I really haven't gotten over since. And he has never understood quite why I had such a violent reaction to that because I didn't have much in the way of criticism to make of it. It was just the whole contextal atmosphere of the thing that was wrong. This I think too is why students get such heavy doses of that kill off any tendencies towards creativity because whatever they read is just finished. Here is physics, you know what it is. Here is psychology, you know what that is.

Taylor: Yes, and we give people no training or experience with the different stages of knowledge, so to speak.

MacKinnon: I was struck by what Carl Rogers said. You started off by saying you had in your background heavy doses of statistical things on the one hand, and a heavy dose of Freudian things on the other and some kind of tension created by these. How were these conveyed to you--by a good deal of close control or a very structured presentation of material, a rather traditional way of presenting this to you and requiring that you pass an examination on it? In other words, here we have a creative individual who has had this kind of experience. Now if we, sitting around the table on the basis of our research, feel we ought to check that all over, I am troubled by the realization that any creative individuals have had a quite different kind of educational experience than the one we tend to talk about here. Now I am wondering if even in your days it was presented in a way to give you more freedom, or were you held to pretty rigid examination requirements, etc.?

Rogers: Let me take the Institute of Child Guidance first because there were no examinations. From different people there were plenty of consistent points of view expressed and with the attitude that any naturally forward-looking, intelligent individual would see that this is the truth. There was none of the business of having to meet certain standards, I would say, except we did not work with regard to ideas. But at Teachers College, though, I don't know quite how to describe it, I would say that the degree of examination procedure was so much less than it is in most current graduate programs that I never felt greatly burdened by that. Here it is getting personal, but part of that is due to something that I have tried to instill into some of my students, that they had better recognize that examination passing is a skill. It has very little to do with knowledge. It is a skill. And for better or for worse, examination passing is something that always came very easy to me.

I didn't see how people could have trouble with exams. And so it didn't fill a very large part of my experiential life because I never stewed about examinations.

Provus: It seems safe to say that you chose to seat yourself at the feet of two different idols, two gods. You somehow had the strength not to be overwhelmed by either and isn't that the thing that so often shows up in creative individuals. One person comes out of an absolute puritanical with a minister for a father, and then goes to the other extreme in a different environment and plays another role. But then he comes back to some other road and has choice in both of these cases and finally makes a choice which was uniquely his own.

MacKinnon: There is a lot of evidence that creative individuals often suffer some kind of cultural dislocation. I think this kind of dislocation or discontinuity can occur in an individual life history as well. I am struck by the ability of creative people who have had certain experiences, not so much to reject these experiences but to free themselves from them. In other words, they have had discipline but it is not a discipline that has inhibited them. They have grown beyond it. And I am a little worried that our present movement, shall we call it creativity, is somehow going to suggest that there is no necessity for discipline, no necessity for getting facts? It becomes such a free-wheeling kind of experience that where does this lead us to? I am troubled by it. I wish my research findings had led me to the point that I'd feel quite clear what the implications are, but I am not clear.

Taylor: You are somewhat in the middle of this conflict yourself right now. What you are partly saying may be that people need experience in learning how to shed things, maybe first to have experienced them and then to learn how to shed them. And if we give them no rules to experience, they will not know how to shed or modify or otherwise improve rules because they have never been under them.

One of our Cambridge scientists proposed a second generation theory of creativity that is somewhat analogous here. For example, a first generation comes to America from Europe. They will have their hands full making adjustments to the transition but he argues that the next generation will be a new blend between the two cultures. They will be caught between the two cultures like we have been discussing. They will produce something different from either cultures that could be in itself quite new and unique.

MacKinnon: It seems to me that you have to have both restraint and freedom at the same time upon experiencing this tension somehow; a creative person may reconcile and work something out of this. I am just a little afraid that we may move too far away from restraints and discipline and this sort of thing.

Rogers: I share your feeling a lot except with one distinction. I agree that it seems as though creativity does often come out of a certain amount of conflict, a certain amount of breaking away from restraint and so forth, but I don't think we can consciously set about to promote creativity by that means. This is where we are in sort of a box. You can't say to teach with many requirements and constraints and maybe your students will get so angry at you that they will rebel and do real creative things. That just isn't feasible, even though it is quite essy to point out that some people have become creative partly in rebellion against too much constraint.

Mooney: Rather than thinking of it as discipline or as control or restraint, the point may be to think of it, instead, as an item of order. Statistics can be viewed as an order and pursued as a mode of ordering experience, as a mode of organizing. And Freudian outlook can also be pursued and sensed as a way of ordering. That is a different view from being put under controls or restraints. It is a way of realizing the manner in which these different orderings take place. I think there has to be enough control in a sense that at any place where an order occurs with sufficient clarity to be communicable there is a kind of control in the same sense as an artist has control over his canvas. The discipline is not over the person, but it is a discipline of self-realized order by teachers exposing themselves to ordering. And I think a person is fortunate from one viewpoint if he is able early in life to come to a sense of quite different ways of ordering and be left with a necessity himself of evolving an order which succeeds in including what seems to him to make sense. So he is left with a life in which to evoke from himself an order.

Rogers: Let me try much the same thing in slightly different terms. of putting students in real touch with real problems. For instance, we could face students in political science by saying: "All right, here is a coherent view held by Goldwater, and here is a coherent view held by other people." If we really make sure that they got those views, then they are going to work, they are going to think, and they are going to do all kinds of things. But when we teach everything as a closed system such as a just one viewpoint, that's all they have to learn. Rather than external discipline like you are speaking of in the French schools, there are so many pressing problems today and so many insoluble issues that I believe we need to put students next to them in some meaningful way more than by just saying there is a problem. If they really lived in association with those problems, then I think this does supply the kind of self-discipline and internal conflict and so on that both of you are talking about out of which really independent thinking comes.

MacKinnon: I have also thought in lines very similar to both of your comments. If a person gets interested in a system that is not closed, a system that is open, a system that excites him, and if he gets sufficiently involved in it, he develops what we call intrinsic motivation. If a person gets sufficiently strong in intrinsic motivation in some area, then without thinking of it in this way at all, I believe he disciplines himself in order to get the knowledge that he needs, in order to move and to solve these open questions and paradoxes and what not. So I feel what is needed is self-discipline which I suspect is close to your concept of organization. Self-discipline is much more effective than discipline imposed from outside.

Rogers: Maybe we ought to teach courses which are nothing but a series of the paradoxes existing in that given field. This would get kids excited.

Taylor: Maybe we should deliberately give them a wider variety of experiences in education like one encounters in an abundant life and that way they experience a lot of these things without merely hoping they will somehow occur in a completely free system. In our week-long session on creativity and religion this summer we very deliberately set the stage so I tossed a new idea out to the crowd and the leading religious figure there, one with the highest authority, reacted very negatively to this idea in a very firm way and gave about ten compelling reasons why this was impossible. Most of the audience became silent and apparently fell into line with him, but three or four of them openly refused to admit it was impossible and should not be considered. No matter what he had said, they still had some things to say as to why it was not impossible contrary to the message he had given so authoritatively. Afterwards we explained to all of them that he had merely been playing a role so they would have this experience. A couple of them said he wasn't playing the role, that was his true self, because they had heard him respond like that before. Others said he had missed his real calling and that he should go into acting because his performance was so convincing.

Chapter 2

Instructional Media and Creativity: A Universe of Challenges (cont'd.)

Calvin W. Taylor, University of Utah

Multiple Media and Instructional Materials.

We should determine how effective different teachers and different instructional material are in informing, in explaining, or in provoking new thoughts in students. We need to discover the best combination of instructional materials for each of these purposes. We also need to find out how instructional materials should vary in order to inform, or explain, or stir critical thinking, or stimulate questions, or stimulate new ideas and other aspects of creativity in the receiver. What modes of presentation and what types of questions will lead to wonderment and curiosity and to continual searching on the parts of students? Do some media more readily stir increased thinking, increased library reading, and other forms of increased search for new information?

Edling: This point reminds me that practically all of the media now are being produced on a printed format. We write a script, we follow one idea after another. Yet if you watch children learning you will see that children can be watching a television set and be tied into that, they can be having a conversation with some other kids, they can be making something with their hands, and they can know what their mother is doing. There are several things that they can be learning simultaneously. A non-linear film format has been devised and is being experimented with which gives several kinds of information simultaneously to students. This format now is being used at the World's Fair at IBM with maybe 15 or 16 screens simultaneously providing information to students. Talk about stirred imagination! You can just see all kinds of possibilities of interaction if you break away from the linear format of the printed medium.

Taylor: The maintenance of a combination of instructional devices may be important, especially when a new device is installed into the learning situation. When texts are introduced in about the fourth grade, there may be a tendency to discontinue giving the students as wide variety of experience as occurred in the earlier grades prior to their having full-fledged texts. If we are not forewarned, similar curtailment in the variety of experience may occur if teaching machines or television are installed widely.

What instructional media are most effective for having students utilize creative or other specified processes in contrast with media most effective for teaching subject matter content? Another content-process problem is whether creative thinking is best stimulated by first freeing a student from external stimuli or whether the input of information through all sensory channels of the student at one time would be maximized, as in an airplane pilot's receiving information through several senses simultaneously. Perhaps enrichment can occur by having a variety of relevant information transmitted through various sensory channels of the receiver. Following this saturation of the individual with new information, we would instruct him to strive for new creative combinations of various portions of this material. This can be illustrated by having a child see and mimic a variety of dances on TV after which the child would be asked to dance freely to a variety of recorded music.

We need to know the effects of successive as well as simultaneous use of a variety of sensory channels of receiving information. For example, if a large number of channels are used simultaneously for input information, will the human machinery thereby be swamped so that no new thinking action of its own can occur during this intensive input? What are the after effects of such input experiences--does the person become more or less likely to think freely on his own immediately afterward?

With growing evidence that different students do not learn by exactly the same processes, will a diversity of instructional materials ensure that each individual's style of learning can function? If a teacher does not reinforce all of the ways that different students learn, a stamp of disapproval may be given to certain learning methods, no matter how effective they might be for some students. Instructional materials could be designed to permit and at times to deliberately cultivate different learning methods across individuals and also within individuals.

To what degree do different media carry with them some pretense of omniscience? In the transmission of the same information through different instructional media, would the students feel that they have a chance to toy with this information in some cases whereas in other cases would they feel that it is more nearly perfect, sacred, unchangeable information? Even for a given medium, which of the following best promotes creative thinking in students: flawless instructional materials, or those containing typical human errors to be discovered and corrected as the instruction moves along? The latter may give students experience that they will encounter later on their own.[*]

---

[*] For example, during a recent tele-lecture to audio-visual specialists, the author decided with his teammate at the other end of the telephone that the presentation should not be flawless but that we should openly show to the audio-visual specialists in the audience our struggles using this technique.

A current speculative emphasis about creativity pertains to the need for an open system to encourage multiple approaches and a divergence of thought. Relatively unstructured situations presumably set the stage so that the mind is free to deal with the problem without much restriction. If this is a sound approach, we need some instructional materials without too much structuring to permit a free play of the mind. On the other hand, if a richness of exposure is important in the preparatory stage of the creative process, considerable relevant material should be transmitted to the receiver to give him adequate "stuff" with which to work as he creates or reconstructs insights in a given field. We should check students' responses during and after the exposure to instructional materials designed to accomplish the above purposes to see if desired reactions occurred.

Another "open system" may be to expose students to a wide variety of separate closed systems and separate channels of information. To avoid compartmentalized thinking, the students could then be required to think and work across these systems two at a time, three at a time, etc., in order to get a rich cross-sectional view of a field.

An open system may stir some to do convergent rather than divergent thinking, as they attempt to crystalize and close down the openness which they do not particularly tolerate. Contrarily, a closed system might provoke some to a greater variety of responses as a counteraction to the over-tightness of the system; the more narrow the system, the more strongly may some counteract the "propaganda" by thinking up a diversity of alternatives. Whenever certain closed systems tend to make the majority think more alike, an accompanying effect may be to instill certain restrictions in their thinking, unbeknown to them. Such restrictions may handicap their thinking in that area thereafter. Consequently, we need to know much more about the effects of open and closed systems upon the divergent and convergent thinking of learners. For example, it has been said that Eskimos function better as far as dealing with the total field of perception than do students who have been in typical classrooms where information is compartmentalized and where learning is accomplished much more piecemeal.

While there is debate as to the role of openness or lack of structure in the situation that would be ideal for creativity, there is little controversy about the need for great involvement of an individual to hope for high level creativity. Students should have some practice in getting deeply involved, in giving long sustained effort on one sufficiently difficult activity--possibly during school hours since it might be more difficult to hope to attain after school in the many different home environments.

Students need to be able to sustain intensive effort and to experience the feeling of attaining closure on longer and more complex problems. Nowadays, a main experience students have is that of completing, without revision, a small piecemeal task on which they can obtain quick closure and which they can cast off, without further concern, in the form of brief daily assignments.

In the 1959 Utah conference, Cattell stressed the importance of introversion in contrast with extroversion in creativity, together with the need for more stress on introvertive education to develop more self sufficiency, independence, and inner directedness if the nation needs creative scientists more than salesmen. The need for a rich inner life should be recognized and developed through appropriate instructional media. He also felt that certain instructional approaches (such as TV) may be intrinsically more attractive, but that we should not fall into this attractiveness and thereby ignore things intrinsically more important.

Since a creative person may have an atypical concept of adjustment namely, to adjust the environment rather than to adjust to the environment, students should learn when it may be better not to adjust to the environment but to try to adjust the environment in a way better for all concerned. Instructional materials might be designed to reinforce the behavior of students who can best solve certain selected problems by deliberately changing the situations.

Instructional Media Designed to Develop the Total Intellect.

We are faced with tradition in our educational setting and with some strong focus on the characteristics on new instructional media with their tangible gadget features. Unfortunately, one therefore expects that the largely ignored areas in education will continue to be ignored, unless special steps are taken to insure that this unfortunate oversight in education will automatically be overcome with the emergence of new instructional devices, such as teaching machines and television.

It is recognized that certain intellectual characteristics are currently more emphasized than others in our present educational programs. A human tendency is to give the most attention to those things that are first installed into the system. Those who can see the obvious and have "sight but not foresight" tend to judge such things to be obviously more important than other things that did not get installed into the system in the first place. On the other hand, some of the characteristics (such as creativity) that researchers on high level talent postponed initially because of the difficulty of the measurement task may be equally and sometimes more important than the intellectual characteristics initially singled out and thus initially incorporated into education and the talent searches. In other words, some progress has been made through research so that attempts could now be made to seek creative and many other different types of high level talent in addition to the intelligence type of giftedness. Psychological research on human characteristics has indicated that there are a large number of intellectual processes that have as yet been largely ignored in identification and development of talent in education.

We all need to recognize how precious little we really have known in the past, not only about the anatomy and physiology of the brain but also about the details and complexity of its psychological functioning and its psychological potentials. With new findings on high level talent emerging and forthcoming, teachers and entire school systems should no longer ignore but should pay serious attention to creativity and other high level processes and should try to search with researchers for greater understanding and know-how about these processes.

We should be very careful to see that the discovery and development of new instructional media such as television and teaching machines do not overshadow or even blot out the awakening at a similar time in history, to the fact that many high level intellectual types of talent and processes have been too much ignored in the school systems today. Each of these new developments could find its proper way into the school system. To insure this end, special attention must be given to see that other high level processes such as creativity, planning, decision making, and communication abilities are properly recognized and given due attention in the educational process.

Since there are many characteristics believed to be important in creativity and in other important intellectual activities, we need more deliberate techniques for developing such characteristics. We need to determine which instructional media might be most effective in developing each of these characteristics. For example, an important characteristic is the ability to manipulate several ideas concurrently in one's mind.

The tendency and willingness of students to revise and rework materials and to strive for more comprehensive answers should be deliberately developed more intensively in our school programs, according to our own research findings on communication and creative abilities. We may have to find a way to help fellow students and also teachers to learn to live with (and not automatically fight) those students who display these behaviors of wanting to revise and wanting to strive for more comprehensive answers. We may want students to practice reworking and restructuring and revising material presented by television or other methods of presentation, for example, as a way to safeguard against the dangers of single views being too effectively propagandized.

The general question then arises about different instructional media as to whether they can stimulate or even allow diversity of response and thus divergent thinking instead of slavish following and memorizing of the material offered. Another question is whether students are encouraged or even allowed to come up with ideas of their own, as illustrated by their own comments in the margin of the book, as they fulfill their required reading assignment. Maybe such encouragement would eliminate feelings of guilt in those students to whom this diversity of responses is occurring quite naturally as they are exposed to instructional materials and situations. I believe that such variability of performances or the production of multiple ideas in given areas should be encouraged at appropriate times throughout our academic program and not largely postponed until the later years of graduate training.

Frequently, students are strongly encouraged to maintain a state of highly focused attention centered on the content being transmitted. One type of attention that is often described as being present just prior to the crucial insight stage of the creative process is a state of broadly diffused attention. Instructional media and teaching methods should be examined to see how students could be helped to effectively experience this state of broadly diffused instead of narrowly focused attention. In other words, the question arises as to whether at times in our school students should be encouraged to have their imaginations stirred and have their attention broadly dispersed and their thinking widely sweeping rather than having a highly focused attention slavishly following the single "correct track of information" (almost like the party line) being directed at them, with no consideration of possible alternatives that may be equally good.

Instructional materials are needed that reinforce uniqueness that is not descriptive in a student's response. Barlow has suggested that teaching machines could be used to reinforce the students' knowledge of two extremely different viewpoints in a controversial area and then at least as effectively as any other method, teaching machines could ask for the student's own opinion in the area and reinforce him for having ideas of his own on the problem. We need to find out what other approaches and what other instructional media may be effective in encouraging individualized responses. One approach used in the field of human relations is where the students are given the final question, "What would you do?" as a way to start their discussion and free thinking on the case study problem that has been presented. In such open-ended situations, some teachers may need special training to learn how to make these divergent thinking sessions be fruitful.

In an unpublished study, Robert E. Maizell of the American Institute of Physics found that the more creative chemists differed from other chemists in information gathering behavior and literature uses. Some of the findings were that their families owned more books while they were in high school. On the job they spent more hours reading the literature; they examined more journals; they visited the company library more often; they more often consulted published material outside of their particular specialty in chemistry and in other sciences; and they found monographs, advanced treatises, and older literature to be more valuable. They found handbooks and technical news magazines of less value in solving research problems, and they were less inclined to rely solely on a card index of journal articles, even desiring to develop an index of their own. A striking kind of finding was that they were more often stimulated to ideas of their own by reading and they found reflective study or thought to be of more value as an aid in helping them to solve research problems. It appears that they are searchers and thinkers, not just memorizers and doers in their research activities. This suggests that our instructional materials should allow time for reflective study or thought and should also encourage library research to gain new ideas, even their own new ideas.

While there is a debate as to the role of openness or lack of structure in the situation that would be ideal for creativity, there is a little controversy about the need for great involvement of an individual to hope for high level creativity. However, such involvement may lead to exploration, down unexpected avenues. One writer has cautioned that this great involvement may be highly internal with incubation--but not expression--until the time is ripe to express at the moment of creation. Kuhn indicated that real progress can occur through great involvement in a particular movement or approach in a field, recognizing that such an approach may ultimately lead to a situation which shows obvious limitations in the approach. The stage is then strongly set for some individual to show creative break-aways from the traditional approach.

It is a challenge to try to develop materials that will tend to get students involved and lost in their work so that they can experience this involvement and the possible fruits of it. Those who become so involved may at least momentarily forget about trying various attention-getting tricks or otherwise stirring up trouble.

An Educational Theory for Developing Talents While Mastering Knowledge.

We recently developed a series of five different perspectives for viewing any educational program in order to study the features which it emphasizes, de-emphasizes, or ignores (Office of Education Cooperative Research Project No. 621). New instructional media could be invaluable in overcoming educational weaknesses uncovered through these perspectives. The fifth perspective, to be elaborated here, could also provide a convenient framework for mapping out a particular curriculum with the coverages and emphases desired.

The first perspective, in brief, concerns itself with the identification and cultivation of all the nation's known human resources. The second perspective is indicated in asking to what degree our educational programs utilize scientific research findings fully in this important scientific age. More basic research (R) is needed in basic educational sciences as well as in education itself and especially a much greater amount of developmental activity (D) is needed in a fullscale R & D program to ensure that the relevant research findings could be brought to bear promptly upon educational practices (Taylor et al., 1962).

In the third perspective, education is viewed in relation to the actual world-of-work requirements to see what fresh revelations this approach may yield. For example, in our studies of communication abilities needed in large organizations we found several high level aptitudes and skills, such as revision abilities, talking abilities, and listening abilities, which are greatly needed in several important supervisory and executive activities but which are often being ignored in usual education programs. In addition to world-of-work requirements, this third perspective can be broadened to include other life activities of growing importance with more free time resulting from automation, such as humanities and the arts wherein creativity and expressional abilities can be most useful.

The fourth perspective is indicated in asking to what degree educational programs are giving persons greater self-understanding and self-awareness. In order to increase the range of self-insight it will be necessary to extend the variety of human performances for which responsibility is assumed in educational programs.

The fifth and final perspective which incorporates some features of each of the previous perspectives, involves a new model for viewing educational programs. In curriculum work, we suspect that the focus is often on two things: the means of presentation and the matter to be presented.

A main trouble with this type of approach to the curriculum is that it fails to focus directly upon the student and upon what is occurring within him while the teacher is engaged in imparting subject matter. Consequently, we propose a new three-dimensional model which is much more student oriented. One dimension is still centered on the teaching methods, instructional media, etc., while the other two dimensions are student centered. For example, in the second dimension concerned with knowledge, our focus is on what subject matter is being learned by the student rather than what is being imparted by the teacher--in other words, the knowledge intake of the student rather than the knowledge output of the teacher.

The third dimension also centers on the student, where the major focus should be. This dimension pertains to the psychological processes, the learning and thinking processes, that can occur and can be developed in the student while he is learning subject matter. Measurement research on high level abilities and talents, as well as laboratory research on learning and concept formation, have discovered a rather large number of intellectual processes which we can now identify. The main point is for the students to have the experience of using each of these known learning and thinking processes at one time or another while they are simultaneously acquiring a variety of subject matter content in a total education program. For example, students could have the experience of acquiring knowledge by means of various creative thinking processes as well as by memory or certain cognitive processes currently emphasized in schools.

Neither of these two dimensions in students should be ignored and educational programs could be evaluated in terms of these two student-oriented criteria. First, how much have students achieved in subject matter mastery and, secondly, how much have they achieved in terms of experiencing and practicing and developing the entire keyboard of their minds--the full range of their potentialities. The view is that subject matter is the stuff on which the mind feeds and grows. Or alternately, the students are developing their talents while they are growing in knowledge.

One task in education is to attempt to maximize transfer of training effects or to obtain as much spread effects as possible in terms of later educational and other life situations. When a student learns a certain bit of knowledge, it is hoped that this knowledge will be found valuable and be available and be used in later situations. From this model emphasis is also placed on student processes so that as later situations are encountered, several of these learning and thinking processes experienced in school will be available and one or more will be found to be appropriate for use. Therefore, this model would capitalize on possible transfer effects from both content and processes and thus increase the total chances and magnitude of positive transfer. Instead of betting solely on transfer of knowledge, potential transfer of thinking and learning processes is also deliberately planned. In fact, we suspect that transfer of processes may occur more frequently and with greater effect than transfer of knowledge. But we of course are deliberately hoping to capitalize on both types of transfer effects by focusing simultaneously upon both content and processes in the students during the educational program.

One version of the proposed three dimension model is presented in Figure 1 with the special focus on the two dimensions of the content learned by the student and the processes in the student. This two-dimensional surface of the model has been subdivided into cells, each of which represents one particular content-process combination. Since any of several different classification systems of student processes could be used, two versions will be presented briefly here.[2]

The simplest model as shown in Figure 1 allows for the current awakening to the existence of several different types of giftedness. Here the different thinking and learning processes in students are represented by different types of giftedness, or different types of talent in terms of processes. One could check to see if only one single type of giftedness were focused upon or perhaps only a relatively narrow band of talent out of all possible types of giftedness was being developed in a program. This classification system may have quite understandable titles such as Giftedness in Memorizing, Academic (traditional classroom) Learning, Critical Thinking Processes, Productive Thinking Processes, Creative Thinking Processes, Planning Processes, Decision-Making (Evaluating) Processes, Communicating Processes (of various types), Human Relations Processes, Leadership Processes (of various types), and other kinds of giftedness.

The process-in-students dimension could alternately be subdivided into intellectual and nonintellectual processes as indicated in greater detail in Figure 2. This alternate approach is to recognize and utilize certain research results in forming the subdivisions

---

[2] The content categories in the other dimension could likewise be open to question.

PROCESSES IN STUDENT -- TYPE OF GIFTEDNESS

CONTENT LEARNED BY STUDENTS	Gifted in Memorizing	Academically Gifted	Critical Thinking	Productive Thinking	Creative Thinking	Planning	Decision Making (Evaluative)	Communications (Various Types)	Human Relations	Leadership	Other Types of Giftedness
Biology Classwork											
Biology Lab											
Biology Research											
Physics Classwork											
Physics Lab											
Physics Research											
Other Sciences											
Mathematics											
English											
Languages											
History											
Art											
Music											
Various Craftsmanship											
Health & Physical Education											
Etc.											

Teaching Methods & Aids, Teacher, Fellow Students and Other Environmental Factors Affecting Thinking & Learning Processes

Figure 1

An Alternate Representation of Two Main Dimensions, Content Versus Processes, of the Three Dimensions Model

PROCESSES IN STUDENT

CONTENT LEARNED BY STUDENT	Intellectual							Non-Intellectual						
	Cognitive	Memory	Divergent	Convergent	Evaluative	Learning Strategies	Other	Intuitive	Sensitivities	Emotions & Feelings	Involvement	Physical	Other	Totals for Each Row (Σ d's)
Biology Classwork														
Biology Lab														
Biology Research														
Physics Classwork														
Physics Lab														
Physics Research														
Other Sciences														
Mathematics English														
Languages														
History														
Art														
Music														
Various Craftmanship														
Health & Physical Education														
Etc.														
Totals for Each Column (Σ∧'s)														Grand Totals

Figure 2
A Crude Representation of Two Main Dimensions, Content Versus Processes, of the Three Dimensional Model

Teaching Methods &
Aids, Teacher, Fellow
Students and Other Environmental Factors Affecting
Thinking & Learning Processes

of thinking and learning. This includes Guilford's (1964) main kinds of thinking and Bruner's various learning strategies plus a miscellaneous category. Several non-intellectual categories are also listed to illustrate the range of coverage possible.

The school's task as indicated in the third dimension, is to find out what must be done to fill in the desired cells at one time or another in the curriculum. To fill in a particular cell desired in the model, it may take an entirely different approach on the part of schools, different provisions as to how the stage must be set, what teaching methods should be used, and what instructional media will be most effective. Instead of asking what happens in the student when the school uses a particular approach, the more direct question is to ask what procedure the school must use to have the students experience a certain intellectual process while acquiring some specific prescribed portion of subject matter. For example, what must the history teacher do and what materials can he use to have students try to experience creative thinking while learning some historical information? This third dimension provides a most unique and vital role for educators to fulfill, namely, how to bring this all about by the use of anything in their potential repetoire of teaching methods and instructional media.

Since teachers are usually the most crucial of the instructional media, would we find that they differ widely in the number and variety of teaching methods they actually utilize? In other words, do some teachers play on quite a wide range of keys as they present their subject matter, while others play rather consistently on a very narrow range or band of keys? In an entire school program, would the collective set of teachers display a wide array of teaching methods and approaches or would the pattern be fairly similar, narrow, and stereotyped?

Problems likewise arise in each of the other two dimensions, considered one at a time. For example, on the dimension of subject matter content we are faced with the fact that man's knowledge is accumulating and changing extremely rapidly, especially in certain fields. Consequently, are there ways to select a reduced percentage of the growing total content to be transmitted? Or should the nature of the transmitted content be altered in some perhaps even radical way in order to keep up more effectively with the explosion and change in the body of knowledge? Or can we get help from the teaching dimension by finding certain combinations of teaching methods and media that will enable more of this content to be transmitted in a given period of time?

Similarly, many fascinating questions can be raised about the relations between pairs of these dimensions, for example between the subject matter and the means of presenting it (including what the teacher with administrative support does in terms of teaching methods, instructional materials and devices, setting the stage, etc.). One question is whether the same subject matter can be taught by any of several different methods or can only a few teaching methods be used on certain kinds of subject matter? Within a given subject are there parts that can best be taught by one method and other parts that can best be taught by quite a different method? Can certain audio or visual aids be used so that they become, in effect, a teaching method by themselves? And if they can, what methods should the teacher use to supplement such audio or visual methods in order to round out the teaching program--to assure the full transmission of the required subject matter to the students?

Hutchinson (1963) completed a dissertation under my supervision on matched sets of classes of junior high school students as the first deliberate demonstration study of our full model. He held the content dimension constant by having all students deal with the same two-week unit of social science subject matter. He varied the teaching methods and observed the thinking and learning processes in the students. He worked with two different teaching methods by first having four teachers use their typical method and then with a comparable set of students having them try a second, productive thinking method in which the students were conceived to be "thinkers" and not merely "learners." By recording the kinds of thinking displayed by the students in both types of classes while they were learning the subject matter, he tested numerous hypotheses. All but one of them showed significant differences in the expected direction (the one exception also approached but did not quite attain significance). The students appeared to enjoy school more in the productive thinking classrooms and learned at least as much or more subject matter under this second productive thinking set of conditions. And a new group of students (independent of "IQ" type of talent) emerged as the star performers in this second type of classroom. Thus, in the traditional classes, the IQ type of giftedness was being utilized while subject matter was being learned and in the second type of classes an almost entirely different productive thinking type of giftedness was being used while the same content was being learned.

This section was included to provide guidelines for instructional media specialists to take advantage of the three dimensional model. They can evaluate what types of media already exist and what types need to be constructed for live classroom situations to help fill out the particular set of cells in the model as desired by curriculum planners.

Instructional Media Designed to Look at Past, Present, and Future Problems.

Since fellow students can have an important effect on each other, teaching materials are needed which will increase the percentage of the students with the readiness for receiving new information, a readiness for change, and an ability to allow and even encourage others nearby, as well as afar, to produce and create. Our texts and other teaching materials might have to partly focus explicitly on unsolved problem areas with much more attention on a forward view, instead of merely on past knowledge with a backward viewpoint.

Materials are needed which will give students practice in generating new information and experience with a variety of processes which will serve this purpose. More time should be allowed during instruction and more attention in all instructional materials to what we do not know and how generally one might get started to find the answers to things not currently known.

Although our understanding about what happens at the frontiers of knowledge is relatively meager at the present time, we nevertheless should try to design instructional materials that try in part to teach what the state of knowledge is like at the edge of the frontier. We should more deliberately attempt to learn about and teach the processes of moving back the frontiers of knowledge. The focus at times should be in this moving frontier area and at other times should be back at the more stable core of knowledge. Techniques are needed that will clearly impress on students that even the stable core of knowledge can be affected and can change as a result of the efforts and findings at the frontier of knowledge.

In order to prepare students for new developments it might be efficient, for example, to use radio or television to help cover what is currently going on (at the leading edge of knowledge) in the way of new developments in the field, what the unknowns and unsolved problems are, what the likelihood is that work will be started in the near future on some of these unsolved problems, and how they might be attacked. Through mass communication media the best experts in the field could put across these messages in a brief presentation to large numbers of students in our nation, while the text, the teacher, teaching machines, and other instructional materials could continue to focus on having the student learn what is already known in the field.

We might make such a television program more meaningful not only by telling things we now do not know about the subject, but also what we did not know about the subject 10 years ago that has been discovered in the last decade. This may bring out sharply that the textbooks they are using may be lagging behind several years in the presentation of what is now known. For example about half of the drugs that you can now buy in the drugstore had not been produced and were not for sale a decade ago.

In this way, powerful mass communication media might be utilized as effective carriers of change and as transmitters of the state of knowledge, indicating not only what is known but also what is not known. It is highly likely that those top authorities who are effective communicators would welcome the opportunity to discuss the unsolved problems and challenges in their field and show how we could try to work in the areas where we do not have answers. They could try to indicate the type of "handles on the problem" that will enable us to start getting answers in these unknown areas, similar to the ways in which man, during past history, has changed other areas from the unknown into the known.

We need to determine how different instructional media can help in producing "tomorrow minds" rather than "yesterday minds"--approaches that will develop sensitivity in looking for and in focusing on the unsolved rather than the solved parts of the field of study. Techniques are needed to help students and teachers in recognizing and in learning to state explicitly these unsolved aspects. Deliberate attempts of this sort may be required in order to overcome certain features of the present program which may not be merely ignoring creativity, but may be tending to have a negative effect so that creativity may be disfavored or even crushed. For example, in a study by Frank Jex of our campus, reported in our third (1959) Utah conference on creativity, the correlation between overall teaching performances as rated by supervisors and ingenuity test scores of these teachers was -.38, indicating that ingenuity in teachers may be disfavored in certain academic organizations. The question remains whether teachers with such characteristics develop similar ingenuity characteristics in their students to a greater degree than do other teachers.

Instructional media could be very effectively used in reducing the lag between research findings and their application to education. For example, an enlightened and alert educational organization could be looking upstream at research currently in process in order to prepare instructional media on these important research findings, as soon as they are forthcoming, and to prepare the educational system for the installation of these findings with minimal lag. The development of new instructional devices can eventually free teachers for more productive and creative tasks, analogous to the way that computers and other valuable machines available can free man to tackle problems that have previously been postponed for future generations.

It may be advisable to have students deliberately experience conflict situations of tradition vs. change, and also experience the two most extreme outcomes from these situations, one in which tradition and the other in which innovation completely wins.

Likewise, students need practice in the processes of receiving and integrating new information into the existing body of knowledge. This would include the experience of reorganizing a body of knowledge whenever required by the receipt of the new information that is revolutionary in its effect. New media like television, could be used to expose students to a wide variety of approaches in attempting to put across newly obtained information. The students might be encouraged to recognize and even develop in themselves a diversity of approaches as they are asked to transmit information that is new to an audience.

Possible Effects of Individual and Combined Media.

Certain radio presentations may allow freer play of the listeners' imagination than is true for many television programs. A broader question arises as to whether imagination and creativity can be stirred more through listening vs. seeing events or through listening vs. reading verbal materials or through some best combinations of the above. Another question that arises is whether slow or fast presentation in scenes or in speaking, for example, has a greater effect on the thinking processes in listeners, especially in stirring or allowing them to be imaginative.

Some hunches have been expressed that radio may be better at stimulating creativity and imagination than television. If this is true, it may partly be due to the fact that there has been more experience in producing in radio than television broadcasts and that radio has been faced with a period of greater challenge to maintain its position in our society than has television.

Television might be used to display to a nationwide audience of students certain features of different types of creative abilities, as research findings emerge on these different features. The crucial period to develop creativity in the students may be immediately after a certain type of television or radio program rather than during the program proper. Again teachers would have to learn what they should do after these programs to help bring about the development of creativity.

It is believed that the more complex and expensive teaching machines which deal with troubleshooting training come closer to developing characteristics related to creativity than are the simpler machines. Perhaps it will be possible in the near future to produce less expensive teaching machines that will prove to be well suited to the development of creative characteristics in the learner.

It is recognized that some of the newer instructional media like television and teaching machines may prove to have less limitations than they currently appear to have as their program producers are challenged to try to do more things with them. In other words, there may be several ways yet to be discovered in which these media can be valuable aids in the development of creativity in the students. At present television, for example, may be quite a powerful media for stimulating interest in persons, rather than activity. With certain modifications, TV may be able to stimulate both interest and activity so that observers will not be merely passively absorbed in watching a program. Or if TV should become more of a two-way communication device it would have greater flexibility and other features that might enable it to be much more effectively used in the development of creativity.

At the present stage, if TV is to be utilized most effectively, we sorely need creativity in attaining inexpensive ways that will permit recording of all live TV shows and multiple revisions afterwards, as needed to improve such shows. Fortunately, with tape recordings, this type of revision can be accomplished quite economically.

At times one may want to stir questions in the audience. We need to learn whether questioning in the TV audience will be increased if a small audience of very active questioners appear and participate in the actual TV show.

Another of the many unanswered questions is whether we can increase the number of different ways of receiving information and the versatility of receiver reactions through deliberate variations in instructional materials and instructional media. An answer to this question may facilitate our knowing how to teach students to develop a variety of skills needed for different purposes. Another question is whether instructional materials can prepare teachers for change by illustrating greater versatility in approach and by making it possible for teachers to be versatile by the use of a wider variety of instructional materials.

We should recognize and do studies on the possibility of combination of media and their effects on creativity. As educators, we need cross media thinking and cross media research. For example, students might attain greater versatility of thought in a field if they receive a rich exposure to the current information in that field, through a variety of media as well as through a variety of their own sensory channels.

Another question arises on the combined effects of different instructional materials. We need to determine whether one instructional medium might tend to blot out the positive effects on creativity of other instructional media that have been specially devised after a long period of intensive research and development. It would be sad to have such a counteracting effect occur after we had learned, through major research efforts, to effectively develop creativity through one well-developed approach.

Teaching machines might make learning more efficient so that more time will be available, not necessarily for doing more of the same thing, but to free and enable teachers to develop additional kinds of talent in students.

There is at least a two-fold task in teaching creativity. One is to have students learn to recognize and appreciate creativity in others and in their products. The other is to try to develop creativity in the person himself. There have been deliberate attempts to train creativity through creative training course starting over a decade or two in a few isolated spots, particularly in business and industry. Some of these creativity training programs have become more explicit and some instructional material has been prepared for use in such special courses. One person who has developed a special course for this purpose feels that this type of training should now be spread as samples throughout the entire curriculum in education rather than lumped together in only one single time and place. Other special courses are being initiated in several different educational programs. There is a real need to find if truly high quality creative processes have been more likely to occur over the long run, as the result of such deliberate training courses.

As new instructional devices are developed, new principles may emerge which can be valuable for learning. For example, appropriate modification of the fading principles in teaching machines may be utilized to encourage the student to make improvements or other variations in the original material.

According to Barlow, the classroom situation also permits unique interaction attempts with students if the teacher so desires. Assume that a teacher has a real feel of the nature of the creative process without having yet attained the ability to put this experience across to students. As the teacher tries various approaches to put it across, the students can reinforce him whenever they are successfully getting the feel of creativity. They can approve him when his attempt is successful. The teacher can thereby learn which methods are effective for giving his students the ideas or experiences that he wants to transmit.

There are hunches that most teachers soon settle into their own particular style of teaching without much variation thereafter in that style. Some teachers may use multiple instructional aids whereas others tend to use only a single type of aid. The effect upon the students of using multiple versus single instructional aids needs to be determined. Do students prove to be more versatile in learning if they are exposed to a larger number of media? What is the effect on students of having a large number of teachers per day so that they get exposed collectively to a wide variety of styles of teaching? Will students tend to be more flexible, imaginative, and creative if they get exposed to a wider variety of instructional materials?

Can human-like performances and the various revision steps in improving these performances be put across to students through certain instructional media to show that flawless performances are rare and must be diligently worked for to attain? Can other instructional materials be effective in training teachers and students to pick up where TV or film demonstrations leave off and thus stimulate imagination?

Immediately after students have seen the interesting film in which a person prepares his face and makes himself into a clown, how effective would it be to have the students draw the type of clown they would most like to be?

It is realized that some creativity can emerge in thinking about the use of new devices such as teaching machines and television. Some versatility and creativity are valuable assets in those who produce instructional programs through new media. While creativity may be displayed by some of the staff who are producing various instructional materials, this does not mean that creativity is necessarily called for in the students as these instructional materials are used in the class. It may also be possible that some creative characteristics such as flexibility and ingenuity are required in teachers in the utilization of certain instructional materials. In the daily news programs presented to classes on either radio or TV, the teacher would have no real chance to prepare in advance and therefore must be capable of evolving plans on the spot during the presentation on how to work the material into the remainder of the class program. Again the experiences of the teacher may or may not be transmitted so that students have a comparable experience.

More flexibility and other creative characteristics may be called for in devising new media, in producing materials for new media, and in utilizing new media than is required of the learner, who is exposed to the new media. In fact, the learner at times may be the forgotten person in this complexity of activity around new instructional media with its corresponding drain upon the attention and energies of teachers and others in preparing materials and programs for the new media. There is some evidence in radio and television educational programs that students have rarely been called in during the development of programs. The reactions to the programs have been obtained largely from those familiar with program production and from teachers, but rarely from students.

Many Research Challenges.

Research is sorely needed to determine what goes on in the minds of different students as they receive information of various types through various types of instructional media. We also need to know more about the effect of instructions and of various instructional media on response sets of students, which affect the reception of the students as the material is presented.

We should do studies about the different ways that students actually learn, including various types of learning through listening. We should determine the nature of programs that provoke new thought and action as distinct from programs that produce a sheer memorization kind of response in the audience.

As new instructional devices emerge, we must insure that we do not narrow down the perspective of our students and the messages that they receive, e.g., through new powerful mass communication media. It may be necessary to take deliberate steps so that students get at least an equally diversity of messages as they had received prior to the use of these mass communication media. This point is especially important because we are becoming increasingly aware of many areas where multiple solutions and multiple alternatives are possible.

Research of the National Merit Scholarship Corporation has indicated that different school atmospheres can help produce different kinds of students. Further clues through research are needed on what features in these learning situations produce these different types so that instructional materials can be designed to help yield a particular type of student desired. If we fail to recognize that different types of students are being and can be produced in different school settings, with the availability of powerful mass communication media, we might blindly fall into a more widespread production of one particular type than ultimately might prove to be desirable.

In using instructional materials to teach processes, it is felt that they can help not only in memory and reasoning processes, but can also potentially help in developing creative and all other intellectual processes discovered to date through psychological research. There is a challenge to try to develop instructional materials at all age levels requiring each different type of intellectual process and to determine the best age level for the most intensive practice in each process. When students experience such a variety of activities, disciplinary problems may be decreased as a by-product. It should be stimulating to try to produce instructional materials that place high value on originality and on high quality products, but at the same time that are so formulated that they are not out of the reach of students.

Research needs to be done to find to what degree the creativeness of the response is modified if we have single vs. complex stimuli, highly structured vs. unstructured stimuli, organized vs. unorganized input, multi-channel vs. single channel of sensory input (either successively or simultaneously), or fleeting stimuli (as in TV, radio, and moving pictures) vs. a stable constant stimuli available for repeated reference (as in still pictures or in the printed book).

In the reports from our Utah conference the participants are presented anonymously during the discussion periods which are printed almost verbatim in the conference report. This anonymous, verbatim reporting of discussion breaks with the tradition usually found in texts and other reports. Readers of these reports have given two comments which are noteworthy. Some state that they seem to be right in the middle of the discussion at the conference and thus they feel like joining into the discussion to add their own comments. Others report that they have a feeling of relief and release upon realizing that experts who have done some of the best research on the topic are so obviously struggling and guessing as they grapple with the different problems which arise in the discussion on creativity. Consequently, they feel that they, too, have a right to join in the speculative discussion about creativity. We apparently rarely transmit this feeling to students through our usual textbooks. We need to try to learn other ways to develop media in a form that will get students more involved in joining in the search for knowledge and in toying with the knowledge that has already been accumulated.

Other media or features of media may have an effect on whether students feel that they have a right of their own to toy with the knowledge in the field. It has been reported that for a few years at least, students felt that they had to obtain special permission from their teacher to cite materials from paper-bound instead of hard-cover books. Students must somehow get the impression that information in the former is not as perfect knowledge as information in hard-cover books.

Perhaps something about the paper in textbooks or the sizes of the margins, etc., may make students feel more or less free to add comments of their own in the margin.

We need to know how instructional materials can help students to learn to make new attempts at the frontiers of their own knowledge and then eventually even at the frontiers of man's knowledge. We also need to learn better how to transmit information to students so that they will learn it and yet still have an attitude that the information is subject to change as man pushes back the frontiers of knowledge--so they will not become too steeped while they are becoming well versed.

We need to know further about how to get people to creatively react to incoming information so that they will incubate it or toy with it, etc. In the field of writing or through television and motion pictures we might expose students to a complex moving picture or directly to a series of events in nature and then ask them to write a full description of what they saw. Following this experience, the class could read classic examples of similar descriptions of nature, giving them a feel of the same task that the creative writer had. As a by-product some of them may gain greater appreciation of the work of great masters in writing. We also need to know how to display through different instructional media the creative process in action and not just the end products of creativity so that students will receive a more accurate and direct picture and feel of this important total process. The challenge is to determine the instructional media that would be most effective in putting across the creative process and in having students experience and develop creative and other important intellectual activities largely ignored to date in our academic programs.

We should investigate if instructional media of certain types can effectively teach students to develop and utilize self corrective devices. Can they learn how to check on what they have done to give themselves some feedback as a basis for correcting or otherwise reworking some of their own processes, procedures, and products.

It may prove to be wise to display to students samples of finished products that have certain characteristics. An eminent composer on our campus tells the story of two term papers with different characteristics. One paper as judged by its grammar and structure was found to be very sanitary and would be evaluated high in terms of that framework or judgment, whereas the other paper presented a moving story of great interest and carried a fine message even though there were many mistakes in grammar, spelling and the like. In his judgment, the latter paper represented the better one, for although it was not sanitary, it also was not sterile.

People who are inhibited in producing new ideas might be helped by using devices found to work with people who have a fear of public speaking. If a person plays a role of another person in a play, or speaks through a puppet, or from the unseen background while a filmstrip is presented, he often feels much less personally on the spot and may give a much better performance than if he is directly in the limelight. It may be that we can reduce hindering or blocking effects to creativity by having people express their own ideas through role-playing, through puppets, or while commenting on film strips or on other instructional materials where the materials instead of the student are directly in the limelight.

Appropriate materials might be valuable in developing flexibility in setting different levels of one's own critical-mindedness according to the requirements of a situation. Other materials could require students to practice abandoning classifications traditionally used in organized subject matter fields, and to try to replace these with new classifications, including unheard of possibilities. Teachers with the help of other instructional devices should have students look for crude analogies across fields, while not expecting such analogies to be perfect.

Instructional materials and methods need to be designed so that a person can find and practice the channels through which he is more effective in expressing his creativity. Devices may be developed which will help students to experience and to learn whether they are really more interested in ideas, things, or people, and thus where their chances for greater creativity may lie as far as interests are concerned. Instructional materials might also aid the students in discovering their typical response-set tendencies and to learn about other response-set possibilities including those that might lead to creativity responses in a situation. Instructional programs and facilities should be designed so that part of the time is spent in having the students use texts, literature, and other instructional material as springboards for new ideas of their own (which according to my experience, will prove to be a new and possible difficult experience for most students.)

Both creativity and instructional media can have implications across all disciplines of knowledge. They thereby can cut across fields and overcome boundary problems that tend to arise. We need more cross-field thinking and action programs. Creativity and instructional media, either separately or in combination can help us overcome these problems.

It is recognized that all of my comments undoubtedly do not apply equally to all fields nor to all teachers or instructional media; for example, many of these comments may be less true in the arts than in the other academic fields. Consequently, we should try to learn more about the favorable features of instructional media in the arts which might be utilized with appropriate modifications in other fields. Instructional materials that appear to be promising for developing sensitivities in the arts, for example, should be studied to see if they are valid for this purpose. If valid, they could be tried with suitable modifications to see if they can help to develop sensitivities needed in other fields.

One last thought is that it may be more effective at the present stage to develop materials designed to remove hindrances and to untrain for non-creativity than to directly train for creativity.

The reader should be cautioned that practically all of the ideas and examples in this chapter are in a very early formative stage. Essentially they are early hunches, somewhat vaguely expressed, as to how instructional devices might be built and utilized in the development of creativity. Since many of these early ideas may be merely wild ideas, it is my hope that the reader will select out only the ideas that in the long run prove to be sound. The best advice I can give to insure the proper selection from the above ideas is that by means of research to test each of them, or at least the more promising ones to determine if they are sound and will, after adequate development and prosper installation, accomplish their intended purpose.

Other Clues for Creative Teaching and Instructional Media.

Finally, I want to mention my series of 10 short articles on Clues to Creative Teaching in the 1963-4 Instructor magazine. This series contains numerous clues about things that could be tried by the classroom teacher and also could provide numerous clues for instructional media for creativity. Without adding much detail, let me describe the ten topics: (1) Bridges from Creativity Research to Teaching. Of course, certain bridging activities are being dealt with in the present conference. (2) Different Approaches to Creativity including various approaches that researchers have used in creativity and many approaches that could be tried with instructional media. (3) The Creative Process and Education. As I worked on this topic I felt that it is largely neglected in education and has rarely been thought of, except in art education and the arts. The next one on (4) Knowledge and Creativity discusses input and central processing and expression so this is an information processing sequence. This topic can stir as much controversy among teachers as any topic I know. The next three topics elaborate it further into (5) Learning and Reading Creatively, (6) Listening Creatively, and (7) Creativity and Expression. The final three topics include deliberate attempts to foster creativity by (8) Developing Creative Thinking, (9) Developing Creative Characteristics, including personality and motivational characteristics and finally other attempts that might lead to (10) Evoking Creativity. The material in this series contains many suggestions for setting the stage, as illustrated by attempts to develop tolerance of ambiguity, or to give experiences of dealing with complexity versus simplicity.

For the record I want to add our mammoth research efforts in professional areas; we have studied physicians (with Office of Education support), scientists, nurses, and a college faculty to measure what professional workers actually do in the live world. We cannot help but ask to what degree educational activities especially in professional training parallel these professional activities on the job. Likewise we ponder about the likelihood or degree of transfer of training, and already we have troublesome findings that the measuring devices within the educational world cannot be used with much success as a basis of predicting performance in the professional world. Unfortunately, [illegible] we are finding relatively little relationship between performance in the academic world and performance in the professional world.

We even get suggestions that skill in keeping abreast after a person gets out in the professional field seems to have little relation to how well the person did in school. It is as if their education did not teach them techniques for keeping abreast so they have to learn these on their own somehow and the people who seem to be best at keeping abreast are not necessarily the ones who did the best in school. Since knowledge is changing and exploding so rapidly, it appears that education has some real tough problems here. The people who were abreast at the time we release them from our artificial academic world do not have or develop the best techniques for keeping abreast afterwards and they may have to learn these techniques largely on their own.

So we are starting to work on situational training in which we try to include crucial ingredients from the live world of work, work samples which we would have students experience back in the academic setting. At present we are developing situational training and situational testing for the Peace Corps where they feel that although they have a selection program and training program, they certainly do not feel that these are anywhere near being completely on target. They are trying to modify and experiment more and more in both their training and their testing in an attempt to get more fully on target. They say when the people get overseas they will probably endure and fill a spot for two years, but they doubt that the people are at all selected or trained in terms of the kinds of characteristics that are really required when they get there. One type of work is community development, a most difficult assignment. An example of the things they say that are lacking is that there is nothing very strongly in their system which either selects or teaches people to be resourceful. Overseas, they have to do things without the resources they would normally expect to have in the United States, and whether they can then move ahead without resources or in some way to scrouge alternate resources which they can make work through their own ingenuity is part of the problem. Likewise they talk about needing innovativeness and a kind of pioneering, namely of producing something where nothing has existed before. Since this pioneering is partly through people, it could be called social creativeness, a helping to sense problems, initiate ideas and activities where nothing had been done before. The way they now describe it in theory is that they hope that when the Peace Corps person goes in, he does not do the job for the local people, but he catalyzes them to ideas and actions--he plants the idea so that they eventually feel that it is their idea and they then say "let's do this," and he joins them in helping them get it started and move it along and then he pulls out gradually so that they eventually say--look what we did all by ourselves without the help of anyone. But the Peace Corps person got something started and moving which was a very crucial process if you studied how it emerged, and they do it in such a way that is initiated in the community on things that have never been done before. So we are trying to capture samples of these live situations which they will encounter and move them back earlier in the training and testing program. Hopefully we can encapsulate these situations into a small package which can be planted in a lot of Peace Corps programs instead of in just a few that happen to have the ideal situation for community development training like in New Mexico. This situational training is an environmental thing in which we try to set all of the props around the person in order to give him a realistic work sample in a natural life situation. To allow him to go out and use his initiative and resourcefulness and innovativeness through others or to stay back in his bunk, to see if he will go out and tackle something or go into full retreat. This approach has promise in minimizing problems of transfer of training, to more nearly ensure spread effects from training. Although we are trying to provide situations that are as realistic as possible, I am persuaded we are not talking about theoretical versus applied because I think some of these things we are talking about are the real high level skills, the real high level challenges in the world, and not low-level "applied" skills. We have not yet known how to get these vital situations and crucial characteristics displayed in our classrooms.

Chapter 6

BASIC PROBLEMS IN TEACHING FOR CREATIVITY

J. P. Guilford

University of Southern California

S: Let me first express my great pleasure and approval in seeing a conference organized to deal with the subject of "Creativity and Teaching Media," and my appreciation for the opportunity of participating in it. Among other things, the expression "teaching media" suggests automated teaching, which I suspect will be given a proportion of our attention in this conference. For some time, I have been greatly concerned by the fact that, as automated teaching has been applied, as seen in teaching books, its general effects would appear to be anti-creative. Some of the programmed teaching of subject matter has been appallingly based upon about the lowest common denominator of learning as found in the conditioning of rats and pigeons. At best, its use in instruction on substantive matter has been very much restricted to the teaching of concepts; in other words, vocabulary. I suspect that highly intelligent students find such teaching deadly dull.

From very different approaches to educational philosophy and educational operations we are aware of the great need of more emphasis upon student initiative and the fulfillment of the student's intellectual needs, under the heading of the goal of teaching for creativity. This means not only teaching more imaginatively but also promoting by teaching the development of creative skills and creative attitudes in students. Since an array of teaching media are available and are probably here to stay, it is well that we consider how they may be used more constructively so far as students are concerned, both in terms of teaching ordinary subject matter and in developing creative-thinking skills and creative attitudes.

Some Guiding Principles

The writer is not a teaching-media specialist; not even an amateur in that field. The reader should not, therefore, expect to read in what follows anything at all of very specific usefulness on the applications of teaching media to problems of teaching for creativity. At this stage of the general problem, however, it is well for all of us, whether teaching-media specialists or not, to begin, as one should, by considering general objectives and other general considerations. Having answered some of the broader questions, we find it easier to tackle the more specific ones.

Accordingly, in this paper I shall begin with a consideration of some of the broader issues on which I have views. There will follow a general overview of the nature of creative thinking and creative production as we know it from research bearing upon the basic aspects of those phenomena. A general model for creative problem solving will be presented, based in large part upon structure-of-intellect concepts, as a basis for surveying the kinds of skills that need to be cultivated for increased creativity. Some conditions favorable for acquiring these skills will be suggested, and, only here and there, some general suggestions regarding teaching media.

Deciding What Has to be Learned

Always a great believer in putting first things first, I should say that above everything else we need to have clear and extensive ideas about what it is students are to learn. Such items of information, after all, constitute educational goal ideas. Then we should be ready for the next question of how the teaching can best be done. If the answer to this question calls for teaching media of certain kinds, we then find the media, if they already exist, and invent them if they do not. The approach that asks first "Here are some teaching media, what can we do with them to promote creativity?" is a case of "putting the proverbial two-wheeled conveyance before the equine source of power." By the order of general steps suggested instead, having decided how something should be taught, the next question is "Does any teaching medium have what it takes?" and if it has something to offer, how can it best be used?

Determining What It Takes to be Creative

We cannot get far in pursuit of the first goal without also working toward a companion goal of understanding the nature of the mental phenomena with which we have to deal. Creative disposition or creative potentiality has already been the subject of considerable investigation by one method or another. There is a growing knowledge of the kinds of traits involved in individuals recognized as having greater probability of producing novel, yet relevant, if not socially worthy, results. Some of these traits are in the nature of thinking skills or strategies, often recognizable in terms of common-factor intellectual abilities. Other traits are in the motivational category, including needs, interests, and attitudes. Still others are in the temperamental sphere. From the knowledge about characteristics of potentially creative people, much of which we already possess, we have some basis from which to make a beginning on the problem of teaching for creativity. In fact, such a basis has already been exploited for such a purpose, in many training courses about the country.

Deciding Which Contributing Qualities Respond Best to Training

If we happened to be convinced that all the qualities that contribute to creativity are completely constitutional or determined by heredity, we should of course close up shop and go home. But, being on the optimistic side, and previous experience with teaching efforts give us every right to be optimistic, we should proceed with our efforts. In view of the large number of apparently contributing qualities, on the one hand, and limited resources and time, on the other, however, there is need to make some choices as to where to place our first efforts. The choice is naturally somewhat determined by virtue of availability of particular methods and devices for instruction, but this is certainly a secondary basis for making a choice. A much better basis is in terms of which qualities are most trainable and the training of which qualities will yield the greatest total gains, amount of effort being relatively equal.

Unfortunately, we have no very decisive information as to which of the categories of qualities are most and least trainable. There is some basis for speculation about this point, however. For example, there would be some consensus that temperamental qualities are more fixed either from heredity or from very early experiences and therefore less open to change by new experience in the form of training. There is some basis for believing that the motivational qualities are more promising candidates for change, but there is relatively little evidence as to how large those changes can be, in response to learning experiences. In line with our general educational philosophy and efforts, changes in abilities, including intellectual skills, are most readily changeable through the appropriate kinds of experiences.

In terms of know-how regarding training methods, the intellectual aspects also stand high in the list. In part, this is a matter of tradition. The intellectual aspects of creative performance are more obviously recognizable. Some already exisiting teaching procedures could be applied or could be adapted or developed by analogy to those already employed in teaching students "how to think." Furthermore, such procedures can be more definite and straightforward. Thus we have a repertoire of standard methods such as brainstorming, synectics, attribute listing, morphological analysis, and so on, and such methods are available for adaptation to teaching media by organizing method and medium into single strategies of operation.

Most Training Should Be General Rather Than Specific

Creative thinking is best distinguished by the fact that there are novel aspects to it; novel for the thinker himself, that is. It is obvious that the same response cannot be both novel and previously practiced in the same immediate context. As I have emphasized elsewhere (Guilford 1964), there is always some degree of transfer in every act of creative thinking. Items of information are recalled and used in some connection other than that with which they were learned or in some new form in which they were not experienced before. The implication of this is that the _general_ aspects of information should be emphasized, in the learning of information, and strategies should be learned that have _general_ application in connection with new information

Broader Intellectual Aspects Should Be Recognized

The relation of creative abilities to intelligence, as traditionally known and measured, has been investigated quite a number of times, usually by way of correlating scores from traditional intelligence scales with scores from tests of divergent-thinking abilities, in one way or another. Almost invariably the conclusion is that the correlation between creative potential and intelligence is positive but low. By preface to what I am going to suggest next, I should like to put this kind of finding into proper perspective.

The first point to consider is that, even with a wide range of intelligence scores taken into account, the _linear_ correlation _is_ rather low. But the relationship is _nonlinear_, and nonlinear correlations run a little higher. The scatterplots are triangular in shape, such that we may say that individuals with high intelligence score may have scores on divergent-production tests ranging from low to high, but individuals with low intelligence scores very rarely have high divergent-production scores. From these facts we may state the generalization that being high on what is measured by intelligence tests is a necessary condition for high creativity, but it is not a sufficient condition.

We may also say that no one can be very low in intelligence score and also very creative. That is the way the scatterplots look. But it should be pointed out that the intelligence-test scores used in these studies are weighted heavily with verbal or semantic content and, for the most part, the divergent-production tests have also been semantic. What of the possibility of being highly creative in nonverbal ways in spite of low verbal-intelligence scores? On this question we can speculate.

Generally, the correlations between figural tests and symbolic tests on the one hand and semantic tests on the other are very low. From this general principle, we should infer that the correlations between verbal-intelligence scores and divergent-production scores in figural or symbolic tests should also be low. But will the scatter-plots also be triangular, as they are for verbal tests of both kinds? There is a possibility that they will not and that in spite of low verbal-intelligence scores there can be high creativity in figural and symbolic activities, such as in painting, music, and mathematics. But we can also predict that high figural-cognition and symbolic-cognition abilities are as necessary to creative production in the figural and symbolic fields, respectively, just as high verbal-cognition abilities are necessary for high creative potential in the semantic field of information. This hypothesis can be tested by determining whether the scatter-plots within the figural and symbolic fields, relating divergent-production scores to cognition scores (particularly scores for cognition of units of information) are triangular, as they are in the semantic field. A general conclusion, if the hypothesis proves to be true, is that in whatever field of information the individual aspires to be creative, it is important for him to have a good fund of information of that kind in his memory storage, as indicated by tests of cognitive abilities in those areas. This deduction focusses our attention upon the possession of an abundance of information and upon abilities other than those more directly and more obviously involved in creative thinking.

The same implication arises from another line of reasoning. I have elsewhere proposed the thesis that creative thinking and problem solving are essentially the same mental phenomenon (Guilford, 1964). This idea will be further elaborated in presenting a proposed model for problem solving very soon in this paper. The gist of the argument is that a genuine problem is a cognized situation with which the individual has no readily available strategy for coping immediately. If he solves the problem employing a strategy he has not used before or a known strategy he has not used in the same way before, he has shown some novel behavior, hence to that extent some degree of creativity, however slight.

Now problem solving is just about as broad as behavior itself, involving different kinds of information and different kinds of operations in processing that information. In order to cover the possible range of problems and their solutions, we need a comprehensive and systematic approach such as that provided by the structure-of-intellect theory (Guilford, 1959). In other words, the structure of intellect offers a broad and systematic taxonomy of behavior, and novel behavior may touch upon almost any aspect of it. Thus, I cannot help urging that a plan for creativity training should be sufficiently broad to take into account all potentially useful intellectual contributions. This suggestion should become more reasonable in the light of the later discussion of problem solving.

An example of the broadening of training such as I have in mind is illustrated by the workbook by Upton and Samson (1963) entitled "Creative Analysis." The authors claim that training of college students in a course given with the aid of this book yields an average increase of 10 points in IQ. This conclusion has been independently supported by findings of Brunelle (1964), who also finds marked improvement in tests of divergent-production abilities.

Some recent striking evidence can be cited to show that creative performance of chemists and chemical engineers in a rubber-manufacturing organization is related to abilities other than those in the divergent-production category. F. E. Jones (1964) administered four of our Southern California factor tests to about a hundred such personnel, who were evaluated with respect to over-all creative performance on the basis of scales developed by Calvin Taylor and his associates for evaluating scientists. Tests of factors of originality and of ideational fluency correlated with that criterion .54 and .34, respectively. These abilities are in the divergent-production category. But two other tests correlated .53 (Logical Reasoning) and .37 (Ship Destination), which are for abilities in the evaluation and cognition categories, respectively. A multiple correlation, with a fifth test added, came to .67. The main point of this illustration is that tests of abilities outside the categories that are better known for their association with creativity make substantial contributions to predictions of rated creative productivity and hence suggest that the operations that they measure play roles in creative output.

Training Should Include Giving Knowledge of the Psychology of Thinking

In the development of skills of certain kinds, it is one thing to provide contrived drills that we think will develop those skills; it is something else to provide some enlightenment concerning the nature of those skills along with those drills. In learning to play golf, we do well to learn about the principles of the game as well as to practice swinging at the ball. Forehand and Libby (1962) found that employees in governmental administrative positions improved in their degrees of innovative performances if they had had instruction in the nature of creative thinking along with drills but others who had drills only did not improve. Courses on creative thinking commonly give a certain amount of informative instruction along with drill exerciese in creative thinking, where students are sufficiently mature. Apparently, a high degree of maturity is not needed, for Torrance (1963) found that providing children with only minutes of instruction on the nature of divergent thinking seemed to give them an advantage in tests of divergent-production abilities. On a more extensive scale, it should be of considerable value to give instruction to all students, as soon as they are ready for it, concerning all their different intellectual resources in terms of the factor abilities.

A General Problem-Solving Model

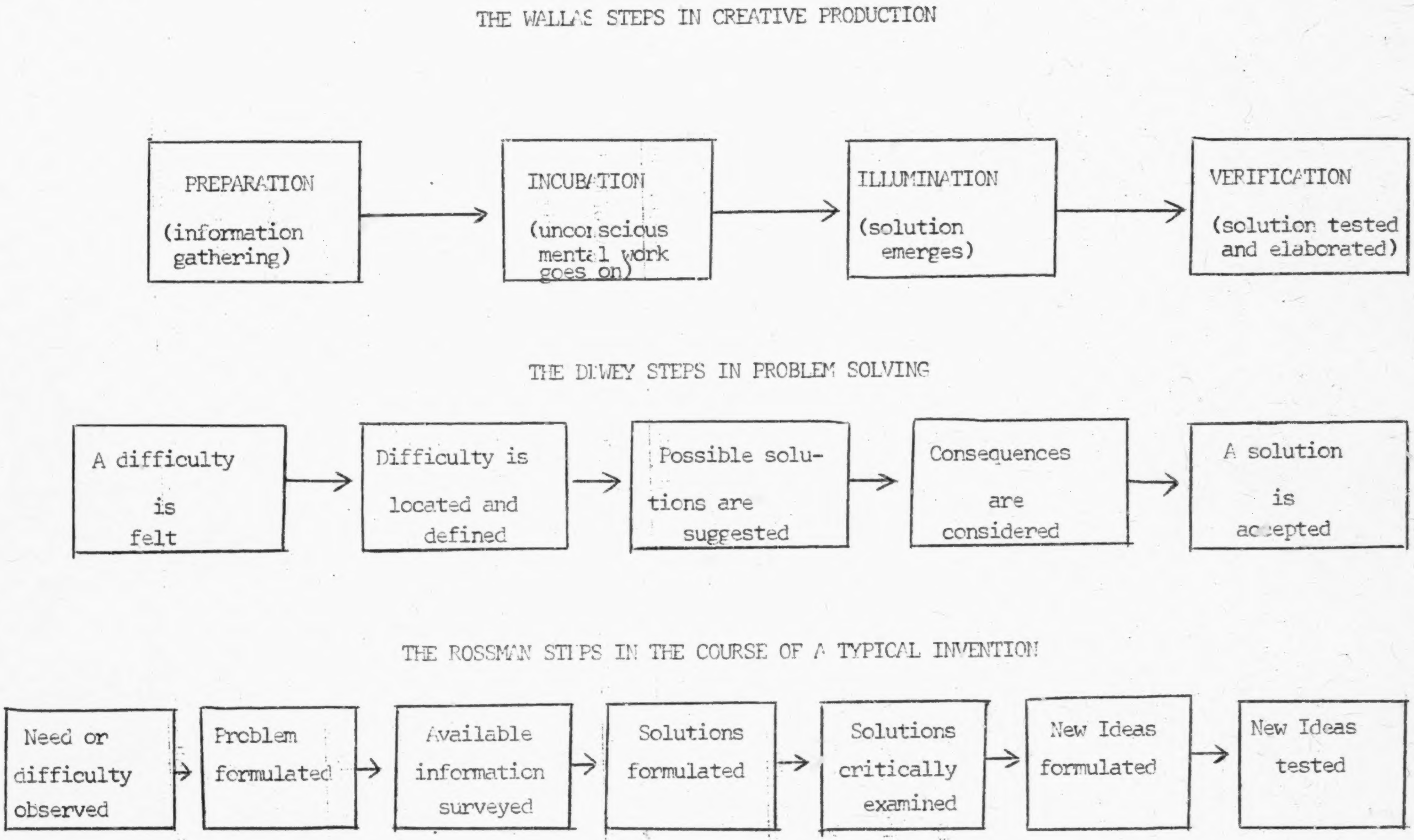
Although I have already indicated that there are many kinds of problems and many different kinds of abilities are involved, depending upon the nature of the problem, there is, after all, a generic pattern of events to which the solution of a problem more or less conforms. There is no one, unitary problem-solving ability, but there is a typical, systematic view of problem solving that may be drawn. This is possible because there are general principles of brain functioning. As in music, the notes and the key may differ but the melodies and harmonies can be parallel.

Before presenting the problem-solving model, a couple of general remarks are in order. One is to the effect that I trust that my linking creative thinking with problem solving does not lead to the reaction I have heard about from other individuals who, in effect, say, "If creative thinking is nothing but problem solving, why so much fuss about it?", as if we knew all the answers about problem solving! A similar reaction is to find the subject of creativity less glamorous, as if there were not enough mystery and challenge regarding the unanswered questions about problem solving.

The other remark is on the question of whether all creative thinking is problem solving. On this point I am not so sure. It is easy enough to equate the two in connection with science, invention, writing, and planning; it is not so clear that they should be equated in the areas of music and the visual arts. In the latter instances, however, we may follow the lead of some psychoanalysts who point out that the artists' problems arise from within themselves; they are problems that require expression in artistic form for their solution. It cannot be denied, at least, that artists encounter problems of expression in the course of their artistic productions.

General Features of the Model

Previous models have been proposed for problem solving, for creative production, and for invention, by Dewey (1910), by Wallas (1945), and by Rossman (1931), respectively. These models are all linear in form, describing in steps the succession of events believed to take place in time between the origin of the problem and an accepted solution (see Figure 1). The details of those models do not concern us very much here, except to point out that, with allowance for the different numbers of steps presented,


THE WALLAS STEPS IN CREATIVE PRODUCTION
PREPARATION (information gathering)
INCUBATION (unconscious mental work goes on)
ILLUMINATION (solution emerges)
VERIFICATION (solution tested and elaborated)
THE DEWEY STEPS IN PROBLEM SOLVING
A difficulty is felt
Difficulty is located and defined
Possible solutions are suggested
Consequences are considered
A solution is accepted
THE ROSSMAN STEPS IN THE COURSE OF A TYPICAL INVENTION
Need or difficulty observed
Problem formulated
Available information surveyed
Solutions formulated
Solutions critically examined
New Ideas formulated
New Ideas tested

Three traditional conceptions of the sequence of events in creative production, problem solving, and invention.

Figure 1

and with the inclusion of a step of "incubation" in the Wallas model only, they are strikingly alike. A quick comparison of the models may be made by examining Table 1, where they are shown in parallel arrays. The striking parallels in these models, proposed to describe the steps in problem solving, creative production, and invention, are traditional support for the linkage of creative production with problem solving.

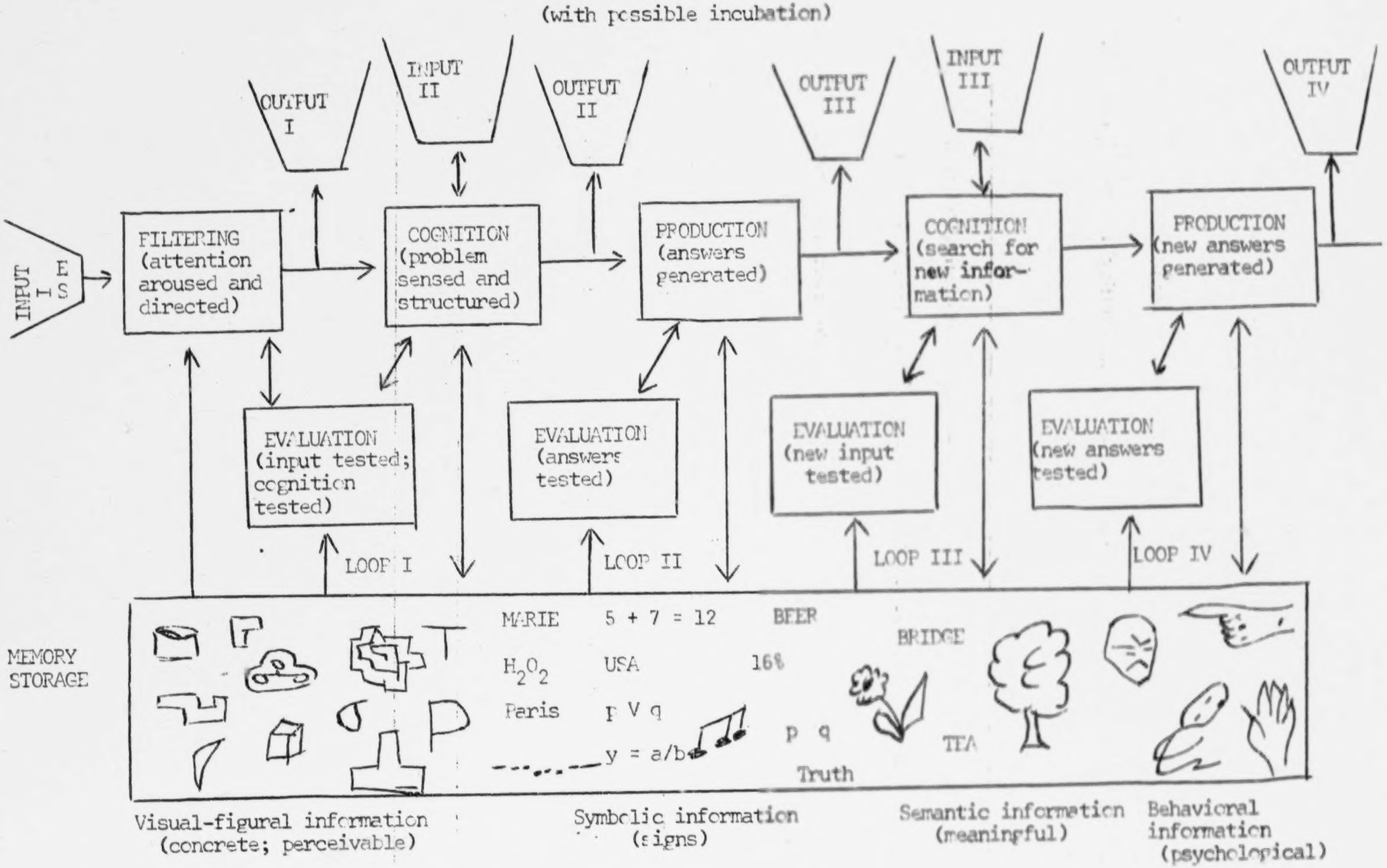
The new model resembels the traditional ones, with considerable elaboration, and with the benefit of enlightenment gained during recent years. Structure-of-intellect concepts play prominent roles in the model, but a few other concepts bear the influence of findings from traditional experimental psychology, form studies of brain function, and from cybernetics.

The Role of Information. --The structure of intellect places a very strong emphasis upon basic varieties of information and suggests that we view the living organism as a processor of information. From the psychological point of view, 'information' is defined as that which the organism discriminates. From the point of view of brain activity, information is a special manifestation of energy in the form of "triggering" functions rather than in its more commonly recognized translation function in the usual physical sense. From either psychological or neurological point of view, information is coded and thus serves well its communicative functions.

The Roles of Intellectual Operations. --The model, as illustrated in Figure 2, is designed to represent a generalized problem-solving episode, which is viewed as a patterned sequence of events within a system composed of a memory store and a set of operations, including cognition, production (divergent and convergent), and evaluation

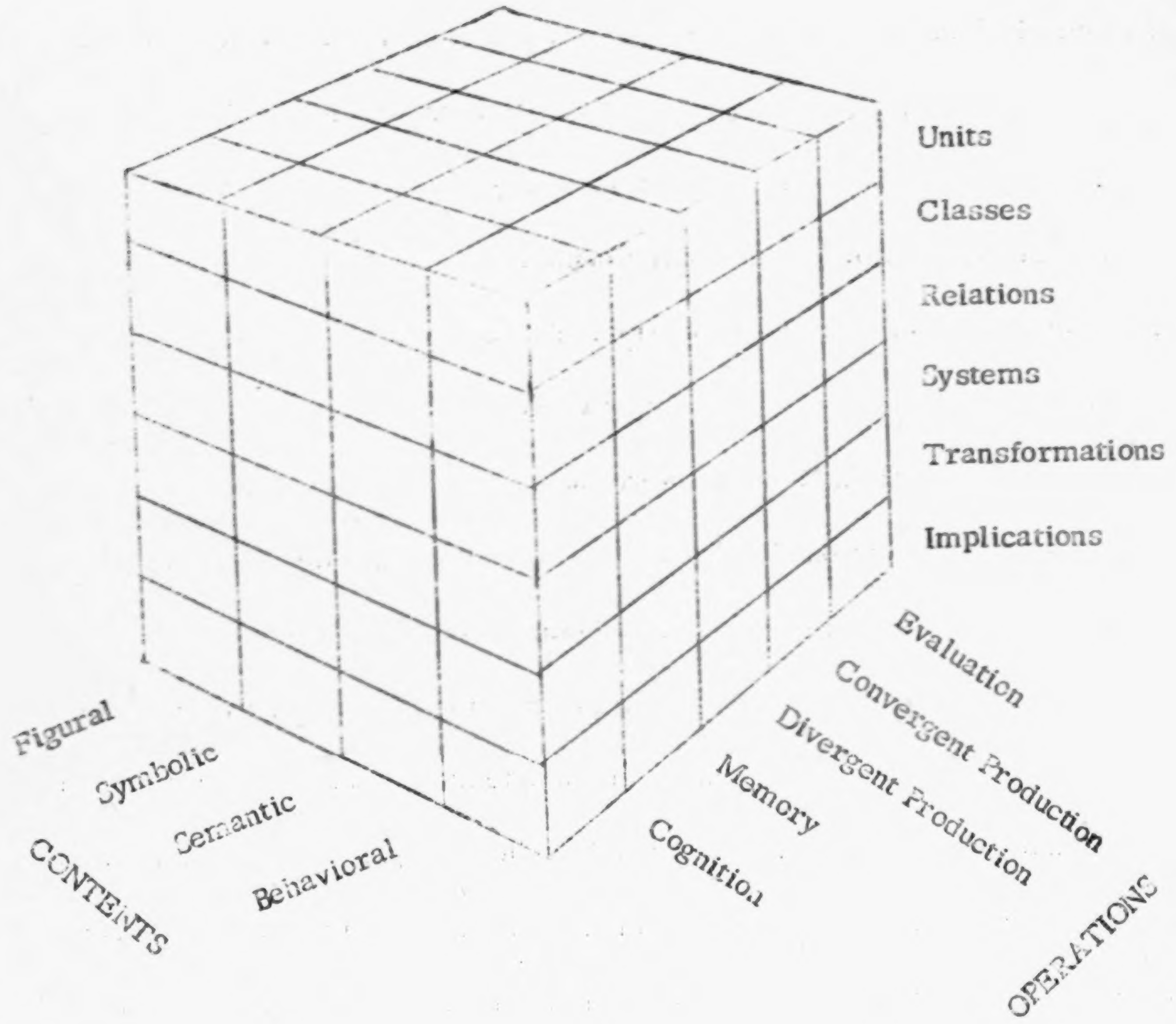
Table 1. Steps in the Solution of a Problem, in Creative Production, and in Invention as seen by Dewey (1910), Wallas (1945), and Rossman (1931), showing Similarities and Differences.

Dewey	Wallas	Rossman
Difficulty is felt		Need or difficulty observed
Difficulty located and defined		Problem formulated
	Preparation (information gathered)	Available information surveyed
	Incubation (unconscious work going on)	
Possible solutions suggested	Illumination (solutions emerge)	Solutions formulated
Consequences considered	Verification (solutions tested and elaborated)	Solutions critically examined
		New ideas formulated
Solution is accepted		New ideas tested and accepted


(with possible incubation)
INPUT I E S
OUTPUT I
INPUT II
OUTPUT II
OUTPUT III
INPUT III
OUTPUT IV
FILTERING (attention aroused and directed)
COGNITION (problem sensed and structured)
PRODUCTION (answers generated)
COGNITION (search for new information)
PRODUCTION (new answers generated)
EVALUATION (input tested; cognition tested)
EVALUATION (answers tested)
EVALUATION (new input tested)
EVALUATION (new answers tested)
LOOP I
LOOP II
LOOP III
LOOP IV
MEMORY STORAGE
MARIE
5 + 7 = 12
BEER
H_2O_2
USA
16%
Paris
p V q
y = a/b
p q
Truth
BRIDGE
TEA
Visual-figural information (concrete; perceivable)
Symbolic information (signs)
Semantic information (meaningful)
Behavioral information (psychological)

Schematic diagram of the flow of information in a somewhat typical instance of problem solving, from input (from environment and from soma) to the output of accepted information.

Figure 2


Units
Classes
Relations
Systems
Transformations
Implications
PRODUCTS
Figural
Symbolic
Semantic
Behavioral
CONTENTS
Evaluation
Convergent Production
Divergent Production
Memory
Cognition
OPERATIONS

Theoretical model for the complete "Structure of Intellect"

Figure 3

of information. The memory store is basic to and has an influence upon all operations, hence it is represented by a long rectangle filled with items of information, indicating general availability (not necessarily of equal degrees) at all stages of problem solving.

Arrows indicate the flow of information within the system, the arrowheads indicating the directions of flow of information. Between any two stations within the model the flow may be in one direction only or in both directions. For example, arrowheads pointing toward the memory store indicate either a searching or scanning process when stored information is needed, or a committing of information to the memory store in accordance with cognitive and other operational events.

Although the general direction of flow of information in the model is from left to right, two important features modify such a simple, temporal sequence. One is that many events occur simultaneously. The other is a "looping phenomenon," a conception prominent in cybernetics. The looping is a kind of circular affair by which information is routed back to earlier points of transmission. Four such cycling patterns are labeled; two involving loops from cognition to memory store to evaluation and back to cognition (Loops I and III), and two involving loops from production to memory store to evaluation and back to production (Loops II and IV). Larger cycles include the combination of the two loops at the right (III and IV), which resembles in form the combination of the two preceding loops (I and II). Smaller loops involve the direct interplay between cognition and the memory store, and between production and the memory store, also between cognition and evaluation and production and evaluation.[1]

---

[1] In the loop patterns and in the prominent role given to evaluation, the model resembles the TOTE model of Miller, Galanter, and Pribram (1960).

Another major feature is the universal dependence of all operations upon evaluation. In general, behavior is self regulating and self correcting, through the principle of feedback information. An example is seen in the operation of evaluation, which helps to select information at the filtering stage near the point of input and to reject or accept information in the operations of cognition and production. In general, the operation of evaluation appears to serve a filtering function as well as other functions.

C: Does your model suggest that this is only part of a sheet, the same thing could reproduce itself?

S: It could go on and on or could stop earlier. Input of information into the system occurs in connection with the operation of cognition, either unsolicited, as in Input I, or actively sought, as in Inputs II and III. The outward-pointing arrowheads in the two latter cases indicate active search for information at input sources. Not shown in the diagram are filtering steps in connection with Inputs II and III, such as appears with Input I, with the involvements of memory and evaluation.

Outputs may occur at various decision points, in the form of suspension or cessation of problem-solving efforts. Output I might be in the form of dodging the problem, regarding it as being of trivial importance, or as being beyond the prospective problem solver's coping powers. For any of these reasons he does not even attempt to understand the nature of the problem. Output II may be in the form of a quick and easy solution, or a decision to suspend operations temporarily, or giving up completely without making an effort at solution. The same alternatives may apply at Outputs III and IV, except that some degree of production activity has occurred. Suspension at any point may mean a condition of incubation, looking toward resumption of intentional activity with respect to the problem.

Although all five of the structure-of-intellect kinds of operations have been mentioned in connection with the problem-solving model, not explicitly represented in the diagram is the distinction between the operations of divergent production and convergent production. Both are meant to be included in the production rectangles. Divergent production is well implied by the cycling or looping phenomenon, either by the direct connection between production and the memory store or through evaluation. In the condition known as "suspended judgment," we may say that there is much bypassing of the evaluative filter. Convergent production can occur only when cognition furnishes a "search model" of such clarity and completeness as to make possible the determiniation of the unique answer needed to fulfill it. Although divergent production may occur before the convergent answer is forthcoming, we can conceive of a search model setting the evaluative filter so well that only one item of information can be admitted from the memory store.

Roles of the Four Major Kinds of Information. --Within the memory store, the four major kinds of information suggested by the structure-of-intellect theory are represented--figural, symbolic, semantic, and behavioral--from left to right. The segregation of kinds of information is primarily for the purpose of display, but, more than that, it also represents some possibly genuine segregation of some kind both in terms of brain structure and brain function.

Roles of the Six Kinds of Products. --Representations of the six basic kinds of mental products are not complete, the six kinds being *units, classes, relations, systems, transformations,* and *implications*. The objects shown in the memory store, each standing by itself, are units of information. When the inner organizations of some of the more complex figures are examined, systems can be seen. Classes are well represented, first by the four broad categories, then by subclasses that can be formed within each major category. Classes and subclasses and cross classifications undoubtedly play important roles in providing "addresses" of items of information in storage, thus aiding materially in retrieval.

A few relations may be seen; for example, the expression a/b and 5 + 7. In each case, the full equation may be regarded as a system, for within it a set of relations is involved. One implication is directly shown, namely, $p \supset q$, and others can be found, such as the tree implying the flower, in that there are flowering trees. No sample of a transformation is shown. An example would be the transposing of the numerical equation to give 5 = 12 - 7 and the altering of the literal equation to give a = bY.

Some of the More Crucial Operations

From experiences thus far and from observing highly creative people, it seems clear that a key role is played by the process of generation of ideas. The recognition of this fact is shown by the emphasis upon idea generation in standard methods of training for creativity. If we want to improve upon those methods and to adapt them to teaching media, or to invent new methods, we should do well to give attention to the basic nature of idea generation. There is both a quantitative and a qualitative aspect to the problem, in that a multiplicity of ideas improves chances of finding acceptable ones, thus involving us in quantity; and acceptable, and even outstandingly worthy ideas, involve us in quality.

In terms of thinking abilities, quantity of production is involved in the fluency factors and quality is involved in flexibility factors. From an informational point of view, the production of ideas is largely a matter of retrieval of information from memory storage. In older psychological terminology, we are here dealing with problems of recall.

The Retrieval of Information

In seeking understanding of any phenomenon, one of the best strategies is to determine the conditions under which the phenomenon occurs and how those conditions affect it. A knowledge of the conditions should be suggestive of what to do in the way of teaching operations, including things to be done, things to be avoided, and difficulties to be surmounted. When we turn to the output from the experimental laboratories on the subject of recall of information, we are likely to be disappointed, because, for the most part, the studies of recall have emphasized non-transfer recall, whereas, as stated earlier, the recall of greater importance in problem solving is transfer recall. In view of the importance of the subject of transfer recall, there have been surprisingly few studies knowingly devoted to it. Some of the principles found applying to non-transfer recall may apply to instances of transfer recall, but perhaps some do not, some apply with modifications, and it is likely that new ones will need to be discovered.

Some Traditional Conditions of Recall. --Among the traditional conditions known to affect recall of information are (1) completeness of cues, (2) overlearning, (3) recency of practice, and (4) a state of relaxation. We might give just some passing thoughts to ways in which these conditions are relevant to divergent production of ideas. Completeness of cues pertains more directly to non-transfer recall, involving the cues in connection with which the information was acquired. But there is a parallel in connection with transfer recall, if we substitute "search model" for cues. Something more will be said about this point later.

Overlearning deserves consideration in connection with transfer recall, but we can only speculate. In connection with non-transfer recall, overlearning has the well-known function of reducing possibilities of confusion of information or interferences. In terms of the given definition of information, it might be better to say that overlearning sharpens discriminations and thus improves the coding of information. A consequence is a lowered danger of negative transfer from the information and a relatively better chance of positive transfer. The transfer angle should be important in the context of creativity training.

Recency of practice is a powerful condition favoring recall of particular information, but it can often be too powerful, when we do not want to recall that particular information. It often provides a barrier against recall of information that we do want. One obvious remedy is to introduce a lapse of time, in other words, resort to a period of incubation with the particular problem. The relative strength of the unwanted idea will decrease with time. There is no obvious way of suggesting how recency of practice could be used to advantage by the problem solver when he does not know in advance what information should be given new practice in order to lend it the advantage of recency. In teaching others how to solve problems, however, the teacher can anticipate information the student is going to need and can effect its practice by the learner just in advance of his undertaking the problem-solving task.

The condition of relaxation may mean several things. One form of relaxation is a general state of lowered muscular tonicity. Another has to do with the effort directed to recalling the information. We often try too hard for our own good. Making a search for something in memory storage is somewhat like sending a messenger off to bring back certain information. Having dispatched the messenger, there is little we can do except wait; expectantly, of course. It is probable that confidence of successful recall has much to do with the success of the scanning operation. A third interpretation of "relaxation" here may be in the form of what Osborn calls "suspended judgment," which means a relaxation of the requirements involved in evaluation (Osborn, 1963). Such relaxation probably serves the purpose of letting more ideas come through the filter and not blocking out the one we really need. It may be that the trainee in creative thining would profit by exercises in relaxation of all these kinds as well as in relaxation of evaluative operations, the latter kind of training in suspended judgment having been amply vindicated.

Some New Conditions Needing Consideration. --In connection with problems of transfer recall, two conditions call for attention, and there are undoubtedly others. Reference was made before to the search model, which serves as the cue, or collection of cues, for instigation of transfer recall. Needless to say, the more complete and the more clearly defined is the goal idea we have as to the kind of end product wanted, the better should be the chances of retrieval of the right kind of information. The scanning process should be thus aimed in favorable directions and the evaluative filter should be set so as to exclude possible competitors. The selective features involved should be relatively more useful in the fields of mathematics, logic, and the sciences, where only one or only a very few alternative items of information are acceptable. But it should also be true in the solution of everyday problems and even in the arts, where much greater latitude must be tolerated. Even in the arts, the creator has some general idea in advance concerning the kind of eventual product that is wanted.

A search model is an item of information that has certain form and other properties. One specification should be that it falls within one of the four major categories of information and another specification is that it falls within one of the six product categories. Beyond these broad categories of classification other specifications must be added in order to give the search model its unique character. Again, we see the importance of classes and subclasses and their organizations into larger systems as aids in giving information the identification that is helpful in seraching operations.

In order that something in memory storage shall be readily sought out by means of a well-specified search model, the information in storage must also be well coded and labeled in corresponding ways. Much therefore depends upon the ways in which information is committed to storage. The manner of learning of the information is undoubtedly important. The practice of rote or senseless learning is often condemned, but not severely enough and not enough action has been taken to correct learning practices in this respect.

As much as possible, the learner should take the initiative, in the way of exploring and discovering things for himself. Things the learner discovers for himself are rarely forgotten and it can be confidently expected that their availability in recall will be relatively high, other conditions being comparable. In order to give acquired information transferable possibilities, the information should not be kept in isolation, but should be given connections with other information, in the form of implications, relations, class memberships, and system memberships. There is entirely too much learning that limits the information to unit form, as in learning concepts with minimal definitional information. The formation of other products involves considerable attention to many properties or attributes of the concept. In this connection one is reminded of R. P. Crawford's emphasis on "attribute listing" as a device for training in creative thinking (Crawford, 1954). One will find much attention to attributes of things also well covered in the book of exercises by Upton and Samson (1963).

Since classification is so important in providing addresses of information in memory storage, considerable emphasis should be given to habits of forming classes and relationships between classes. Upton and Samson (1963) also give a great deal of attention to this kind of exercise. This line of development is carried further by providing exercises in dealing with hierarchies of classes and cross classifications, subjects to which Piaget has given considerable attention in his studies of the logical aspects of intellectual development (Piaget, 1953; Inhelder and Piaget, 1958, 1964).

Hierarchies of classes and cross classifications are kinds of systems, the latter being sometimes recognized as morphological systems. There are also dimensional systems, as commonly emphasized in mathematics and its applications in science. As systems of ideas become very complex, however, certain advantages are lost, due to this complexity. The informational capacity in dealing with complexes of ideas appears to be limited just as perceptual and immediate-memory capacities are limited. One great help for this is the process of unitizing systems, i.e., grasping them as larger wholes. This process has been called a "chunking" activity in connection with memory-span experiments, and it serves a like function of increasing informational capacity. An example in the ideational sphere is to be found in matrix algebra, where single letter symbols serve to stand for even very complex systems of numerical values and the thinker can deal with them as if they were units rather than systems.

Intuition

It is one thing to retrieve a quantity of relevant information from memory storage in accordance with a search model, even where transfer is involved; it is another thing to retrieve information in reorganized form. This event, of course, involves something more than recall. Sometimes the information produced is so different from what was known before that the process is recognized as an "intuitive leap" or intuition. A high degree of novelty is apparent. In other instances there is not so much an alteration of the known information as it is a case of surprisingly remote connections between cue and produced information.

Since such a large part of the process of intuition is unobserved or unconscious, some psychologists may be ready to throw up their hands and to say that we can never know just what has occurred. I do not believe that such pessimism is justified. What can be said is that a new product of information has been formed. The problem is essentially the same as finding out how a mental product comes into existence under any other circumstances. In view of the fact that most of man's mental operations are unconscious and not directly observable, the psychologist must investigate mental operations inferentially, that is, drawing inferences from observations that can be made.

Conditions Affecting Intuition. --As a matter of fact, much has already been done in the direction of investigating operations under the heading of intuition or insight. These investigations are made through the examination of how conditions affect those phenomena. Such studies as Kohler's (1925) experiments with apes, experiments with problems of the type made popular by N. R. F. Maier (1931), and the more recent studies by Westcott and Ranzoni (1963) can be cited. It is incidental that the subjects in such experiments use immediately perceived information as well as retrieved information in solving the problems.

In every case, it is obvious that information must be available and that it is used in new ways, to perform functions that are foreign to it. In such instances the product of transformation plays a prominent role. More will be said about transformations later. The amount of information provided by the experimenter can be varied, as well as the arrangement or timing of presentation. Whether or not insight occurs and the extent of it, if it does occur, can be noted. The size of the intuitive gap to be bridged can be varied, and the width of gap can be systematically narrowed. Personality traits other than aptitudes have been studied as determiners of intuition by Westcott and Ranzoni (1963). There is not space to detail the many results already obtained; the writer has done much of this elsewhere (Guilford, 1965).

Evaluation

The ubiquitous role of evaluation is obvious in the model of problem solving and in what has been said before. We are not yet able to say with confidence just what is involved in evaluation. Among abilities hypothesized as belonging in the evaluative category, eight factors have been isolated and most of them have been verified. Five additional hypothesized evaluative factors are at present under investigation. From the nature of the tests that represent the known evaluative abilities, we can draw a few inferences as to what is involved in evaluation.

In some cases it is a matter of matching items of information--visual objects or combinations of letters or numbers--to determine whether or not pairs of them are identical, the differences being relatively small. Identity vs. non-identity seems to be the criterion involved. In other cases it is a matter of deciding whether there is logical consistency between statements or between parts of a sentence or of a pictured scene. Internal consistency seems to be the criterion involved. In still others, evaluation seems to be a matter of detecting imperfections or irrelevancies, or deciding which of two or more items of information comes nearest to satisfying a criterion that is specified. How many other general kinds of criteria will be found to apply is not known. But knowing whether given information satisfies certain criteria seems to be the best way of giving a single description of evaluation as seen from the point of view of abilities found by factor analysis.

It is of interest to know that Upton and Samson (1963) have included exercises on evaluation in their workbook and that Sidney Parnes and his group at the New York State University at Buffalo have written some preliminary programs for automated teaching of evaluative skills. In both instances, due attention is given to criteria for evaluation.

Elaboration

The process of elaboration is sometimes mentioned as one of the final steps in the total creative production. Elaboration means working out details in what is already a fairly well-rounded product. In terms of the informational view, elaboration is a matter of producing varied implications. Aspects of the total product suggest natural completions and embellishments, and each addition made may suggest additional ones. Observations of the more creative children have led to the conclusion that they tend to add much unnecessary detail to their drawings and stories (Torrance, 1963).

Elaboration tasks are easy to construct for testing purposes, hence they should be easy to develop for teaching and training purposes. One of our figural tests called "Decorations" is a good example. Outline drawings are given of various familiar objects, such as household furniture and costumes, with the instruction to add lines that will provide natural-looking adornments.

Transformations

With the just-completed short discussion of elaboration, which deals with implications, we have gone more specifically to consideration of how certain products of information may be treated educationally. Transformations were mentioned in connection with intuition, but something more can be said about this kind of product, its nature and its relation to special training.

Transformation is some kind of change of information; a redefinition (as when some object is given a different meaning or use); a revision, as when a system is reworked or reorganized; or a reformulation, as when an equation is factored or transposed, or a theory is revised. Osborn's checklist method is very definitely aimed at the encouragement of transformations as a basis of arriving at new objects and new solutions (Osborn, 1963). The suggestions include such admonitions as to try to magnify, to minify, to reverse, to invert, to turn inside out, and so on, each suggested act a kind of transformation.

System Building

One of the most negelected processes in present creative-training procedures, and yet one of the most important of the common creative processes found in the very productive creator, is the construction of systems. Most descriptions of what creative persons do mention that relatively early in the total sequence of events some kind of system appears, whether it be a theme, a story plot, a motif, or other kind of outline affair. This is the backbone, the skeleton, or framework of the major production to come.

Within the total framework sub-systems are also developed, such as melodies and phrases in music, stanzas in poems, equations in a mathematical development, and part devices within a major invention.

An implication would be that psychologists should give new attention to kinds of systems and to ways in which they come into existence. Then there should follow ideas of how to provide exercises of practical, minor scope, with instruction as to kinds of systems and system-construction strategies and steps. The kind of media for the purpose would depend upon the major area of information within which the system-building instruction is to be given.

Concluding Remarks

The opening of this paper promised nothing specific regarding the kind of media to be used in connection with training for creativity or how to use those media. Emphasizing the principle that the selection and use of instructional media depend upon what is to be taught, the choice was to devote most of the space to what we think we know about processes in creative production from the standpoint of basic, psychological conceptions.

It was pointed out that a general operational model developed for a systematic view of problem solving also serves as a good frame of reference for viewing what is known regarding the intellectual aspects of creative production in general. The model of problem solving that was presented emphasizes psycholgoical information and concepts concerning information and its processing provided by the structure-of-intellect theory of intelligence.

It was urged that the training problem be envisaged very broadly, as the problem-solving model suggests that it should be. In a number of instances, it was pointed out that some existing training methods, such as Parnes's workbook (1963), already satisfy some of the training needs and can be considered for adaptation to use with teaching media.

C: May we get a little more information, a little more input, before we begin asking questions? I'd like to know on the output side of your diagram, at each one of these places, i.e., cognition, production, and so forth at each point is there output? Output 1, output 2, output 3?

S: There may be output at each of these points, but not necessarily.

C: Well, how do you differentiate between output one and cognition or output two and production? In both cases it is output and you have said that your example of one is that the guy just dismisses the problem and two he gives just a simple solution. Now production may be the answer, in other words, maybe a simple answer, too. You must have some reason for labeling it output two and production. There must be something that you are differentiating between these two in kinds of output.

S: In other words you are asking me to specify what is in the output.

C: Well, I am not asking specifically. You have two different symbols on your diagram here. There must be some class differentiation among those two kinds of outputs. You've got two symbolic areas--one is output two and the other is production. Now are you differentiating somehow between two different kinds of output?

S: Actually output is departure from problem solving. In the book by Miller, Galanter, Pribram, they speak of a TOTE pattern, which has many features like this. The _E_ at the end of TOTE stands for "exit;" some manner of quitting.

C: I see. Wouldn't it be any activity that would take you outside....

S: That's right; it goes outside the system. That's what is meant by the output category.

C: The word "output" is too suggestive. It is kind of an escape here. Is that what you are telling about from this?

S: "Exit" might be a better word than "output". In the context of the computer language the word "output" was used.

C: I understand now. The other question deals with your dimension of your contents here, or the memory storage, when you differentiate between symbolic and semantic. It would seem to me that symbolic is involved in semantic and meaningfulness is also involved in signs. How do you differentiate between those two?

S: Well, in actual mental operations, the individual may engage in both those kinds of information simultaneously. The information has two aspects, you might say. One is the meaning aspect (semantic) and the other is the symbolic aspect (sign). But psychologically you might say there is a double kind of information; or you might say that the person translates from one to the other, going back and forth, as when a mathematician explains an equation. He is usually doing it semantically. That is, he is translating into semantic form information that was purely symbolic.

C: Aren't these rather an arbitrary rate of content, most concrete, most constructed? You've got four levels. You divide the content into four levels of abstraction. Is that correct? Am I interpreting correctly?

S: I don't know what you mean by levels, but it is like having four different languages, in a sense.

C: Going from most concrete to most abstract.

S: Well, both figural and behavioral are concrete in their own ways, and symbolic and semantic information are abstract in their own ways.

C: That's exactly my question. If both of these are symbolic, the word "beer"...

S: ...and symbolic and semantic both qualify for the concept of abstract but in different ways.

C: I don't quite have that distinction yet.

C: I think figural can be just as abstract as semantic. I think figural information can be just as abstracted and be in figural form.

S: If you deal with figures in an abstract way, you are probably getting over into semantic information

C: I am thinking of the use of it for example in maps. Supposing you stylized a series of maps or something.

S: If you look at the map in terms of interpretations, you are in semantics. Only the visual layout is figural.

C: This visual layout can be relatively concrete, but it can be just about as abstract as you can get. This is the point I was just saying, I didn't like the linear concrete to abstract because I thought it was more than that. I may be wrong. I mean I don't think this describes the model. To me it doesn't, this is all I am saying.

C: Let me ask it this way. Here is a concrete object, a pencil. Now I could have a picture of this thing. The pencil wouldn't be here, but I could have a picture of it, or I could have something else. Now I make the same association, or not the same but a comparable association.

S: If it is a combination of letters alone that is cognized, the information is symbolic. A person might be able to copy the sequence of letters and yet he can't tell you what the word means. This would be strictly symbolic information.

C: I see. Symbolic information then, the signs really are not very useful unless you have the next level too.

S: Now, if you put some rules into their use or put them into a system like an alphabet or number system, they have some significance. A mathematician who thinks only in terms of unverbalized equations is staying within the symbolic area of information. But when he tries to teach this to somebody else, getting into communication with a non-mathematician who is not as facile as he is in thinking purely in terms of symbols, he verbalizes his ideas, which means that he has made a translation into semantic information.

C: This question has to do with memory storage in a way. With figural or behavioral areas if there were not internal rules involved storage would be quite a clutter. There are rules that develop unaided by semantic mediation you understand. And I think this would be important to an artist, or a dancer, etc. At the same time, I remember something that Westcott said to me, although we haven't had a chance to test for it, is he thought that the addition of semantic to the figural classes might aid retrieval. And I don't see any logic to that in your way of thinking.

S: Well, experimental findings show that the learner who can inject semantic interpretation into the material he is memorizing, whether dealing with figures or symbols, learns more quickly because semantic memory is ordinarily much better than figural and symbolic. This may be because it has more generality or more connotative meaning.

C: You talked about the benefit of practice in aspects other than relaxation by deferred judgment and you gave an example of the kind of relaxation provided by deferred judgment. What were you referring to?

S: One other kind is in connection with the general effort in solving this particular problem. Just relaxation from the effort itself. The third kind is a very general physical relaxation, lying down or slumping in a chair.

C: Oh, I see.

C: Going back to the discussion we had here on contents, are these four types of information that you are feeding into the system, semantic vs. figural? Let's take the analogy of a sound motion picture, now the sound tract would be your semantic information.

S: Well, to a person who doesn't understand English, it would be purely symbolic (auditory) or maybe only figural. Only as he is able to organize sounds into patterns belonging to a language system of sounds would it become symbolic; and only if the sound patterns communicated meanings would it become semantic.

C: But assume he understands English and the sound track is in English, this is semantic. How do we transmit pictorial information? Is this symbolic or figural or does it depend on the ty[illegible] information depicted in the picture?

S: How do you translate it?

C: What type of content is it?

S: Well, of course for the person who understands English, he automatically gets the semantic content unless he fails to understand what is being said.

C: Now, I am thinking of the pictorial...

S: I think we have to accept the idea that there is probably an area of auditory-symbolic information parallel to the visual-symbolic information. How far that parallel may go I am not prepared to say.

C: Is there some kind of physiological basis for these distinctions that you mentioned?

S: I think there are two parallels for them, which I am going to suggest to the brain specialists in November when I meet with them. I think we have been on the wrong track in confining the search for brain processes underlying conditioned responses and that sort of thing.

C: What about the work of Lashley?

S: I think Lashley would love this sort of informational approach. His experiments dealt largely with abstractions even in rats.

C: But it wasn't too successful at least from what I understood. It was a very interesting approach. Would you think we will find the physiological basis of thinking?

S: I don't know. I am afraid we won't find things very well localized. I am afraid that most of these operations are so wide spread in the brain that it is in the form of patterns rather than chunks. There is much evidence that figural information is associated with right-hemisphere activity and semantic information with left-hemisphere activity. But this is a very crude type of localization.

C: Do you express some reservations as to whether problem solving is a sufficient model for creative production? I think I observe some people at work who do not seem to grasp the wholeness of the problem, anyway when they start out. They seem to build the thing rather synthetically without any notion of where they are going.

S: Do you think they don't have any problem or do you think they have a problem and don't know it?

C: I think some of them don't want to have a problem ahead of time. I'll put it that way. They resist having a problem.

S: Sort of brousing, apparently.

C: Brousing deliberately. And I think in children's play we see some of this.

S: But somewhere in that brousing a problem does develop. They may just be seeking input, hoping that a problem will arise.

C: Yes, they seem to like to keep problems open to a certain point when they are forced by the kind of convergence that comes in from the work itself.

S: Well, doesn't a scientist sometimes begin the same way, just sitting around thinking?

C: I was wondering how this referred back to your problem solving model? Is this just a delayed phase that comes in later?

S: But are they actually very creative at that stage?

C: Well, I think so. Now this is just an opinion at this point. I have observed the processes of people constructing drawings or paintings. It seems to me that these people often are very creative if you allow for this sort of thing.

S: Suddenly they see that they can do something with what they have?

C: Well, for instance, the problem-solving person in drawing and painting, if you have some feeling for these people they will work off-center with a detail which is fairly controlled, and they will then go somewhere you didn't expect them to and I don't think they expect themselves to. I am trying to construct this backwards, now, as I see it from processes. They seem to not want to go where it would seem they should, but maybe the arts have in a sense built up this lore which curbs this type of behavior.

C: I should think that as they are working in this sort of dissociated, disjuctive fashion, their problem is to find some meaningful total expression for what it is they are attempting.

C: Providing we offer this divergence to the basic meaning which I think often is not done, I agree.

C: Now you are suggesting Maslow's distinction between coping behavior where there is an attempt to solve the problem and just expressing the behavior, gambling on the green. Maybe you're just being expressive in this sense, expression of animal spirits. You are speaking in rather primitive language, yet are you being creative? You are being spontaneous; you are showing lots of the attributes that you'll see in creative activity. But I would not say that this is anything more than a part of the whole creative process.

S: More like the infant just kicking his arms and legs around.

C: Take improvisational behavior with a composer like Bach. He was a master of both types of behavior it seems to me. Yet as I understand improvisation as intended, it is not to know where one is going deliberately. Otherwise how can you claim to have any participation in something that is emerging under process. That is the problem now, as you say.

C: Yes, but you have some goal there haven't you?

C: Your goal is not always there because not all improvisations are equally good.

C: Well, this is what we come to. We cannot rule out the improvisational root or the discovery root or the unintensional root in terms of its lack of creative output because it may lead to equally creative output in a problem-solving approach. That is my confirmed opinion.

C: I think the same thing that no goal at all is a very clear goal and to have a person act in no intended way requires a kind of a learning experience that is a very exacting one. Otherwise a person might act in some given way. I think this is another way of expressing your same idea that if you don't want any particular kind of behavior this becomes a very clear and concise and specific goal.

C: As I observe people in art, it seems that the one person is varying his processes creatively and the other person is frankly, varying his goals, if I may use such a construction. He keeps sorting through things. It is a very ruddy interpretation.

C: Sometimes this is deliberately freeing himself to let one thing lead to another?

C: I think so.

C: For children, wouldn't it be a problem for them in a sense to stay on the paper? I mean to handle a brush and to have this encounter with this surface and have something with the consequence of it so that the problem may be put at a much more manipulative level in a certain sense.

C: Your rambling artist may also be like the inventors that Rossman tells about who are looking for problems and haven't found one yet.

C: No, I think we were asking where does this kind of behavior come in the model?

S: Well, if it is not problem solving, it doesn't fit in the model.

C: Right, it doesn't fall in the model because this is a problem-solving model.

S: One might say that the input filter is highly relaxed.

C: But then others go on to say: "But sometimes this kind of random activity results in problem solving of considerable import." Shouldn't we have that input in the model?

S: But the input changes then.

C: This would be your new input.

C: But isn't your inventor who is looking for a problem already having a problem, namely the problem of finding a problem.

S: Well, you could interpret it that way if he tends to set out to find a problem.

C: See, one of the things that worries me a little bit about this is that I didn't quite see where insight got into this model. But I have heard you touch on it once and then you seemed to get away from it.

S: I mentioned it in connection with transformations, but it goes beyond that. It covers any case where there is a rather abrupt or sudden or at least short timed emergence of a new product. In fact it might be a matter of relations as well as transformations.

C: How about reorganization of the field being essential before you can get a problem?

S: Reorganization is a transformation.

C: But transformations are narrower. That's the whole trick. See what I mean? And you say that it is a function of insight in this kind of gestation, probing kind of activity.

C: You're adding the affective domain.

C: Sure, that's right. That's put real well.

S: Well, the affective aspect comes in through the somatic input; the S indicates all the input from the body, and it would also bring in motivation, emotions, and affection, through such input. This may apply to other inputs also. E is environmental input; S is somatic. In other words, I am working toward an informational interpretation of motivation and emotion.

C: Where would the novelist exit or come in when he has created a character whom he says takes possession of him and he writes the rest of the novel for him. That is we have some autobiographies that indicate this.

S: This creation of a character is a creation of a system, a personality; then whatever he adds to that is elaboration.

C: Looking at your model again with regard to memory storage, would you care to comment on those four categories in terms of longitudinal development?

S: Oh, in the child? Well, I think the infant begins with both figural and behavioral information. He certainly has no symbolic information. Where does semantic information come in? I am sure it comes in before he talks, that is he has ideas he doesn't put into words. I would say that even Harlow's monkeys have some semantic information. One example would be in the reversal experiments where I don't see how a reversal can be interpreted as figural information, because the reversal is something on a different plane, so to speak than perceptual discrimination as such. According to Piaget, mental development is first largely figural and involves the child's interactions of his own body in relation to objects. That suggests behavioral information, too. This interplay helps the child to develop abstract ideas; or semantic information.

C: Now, with regard to sign and the reason, I ask this question whether under signs you fit in the famous experiment of Burtt reading Greek to his son where the son didn't have any Greek knowledge, and yet at the age of eight and a half or so, what he had learned, the previously heard versus and unheard equivalent passages he could learn.

S: Is it auditory-figural information or is it also auditory-symbolic?

C: Yes, I wonder because of the fact that he had already learned English.

S: How old was he when he first started?

C: Eighteen months.

S: He hadn't had a chance to learn much English. So I would say at that stage it is mostly figural information that was put in memory storage, but it could evidently help in memorizing the same poetry later, although later there might well have been some other kinds of information involved.

C: Isn't there a semantic overlay there someplace because both of the mathematicians understand the symbolic information in terms of semantics that to them are meaningful?

S: I suppose certain aspects of it are thus understood. But this means that they translate symbolic information into semantic form.

C: Isn't this partially what they are trying to do with some of the mathematics they are teaching elementary school children now, trying to get away from that purely symbolic and get into a meaningful semantics?

S: They are trying to make it much more meaningful, yes.

C: They are trying to move from one type of information to another type of information.

S: Yes, they are using figural and semantic material very extensively to go along with the symbolic information. You might say the child is thus learning mathematics in three languages. Or it may mean that the learner may choose the language in which he learns best.

C: An example of what you say occurred this summer at Stanford University where a committee of about twenty mathematicians under a grant from the National Science Foundation were meeting to explore ways of developing new kinds of instructional films to aid in teaching mathematics. These people just weren't getting to first base. They couldn't translate out of this symbolic area into the visual medium unless they took examples from engineering or someone in science. So they really were not working in the field of mathematics, well maybe in applied mathematics, applying concepts of the calculus for example to measure a pressure at various levels on a dam. They do very well in films in that area but much of their thinking is again in the nonpictorial, nonverbal realm. So they couldn't have any way of translating it. And they were struggling with a problem that gave them a great deal of anxiety.

C: But this is still a meaningful system to them even if they cannot translate it to someone else because a person might understand mathematical symbols and have a different semantic language--one might be German, one might be French, one might be something else--but they could communicate through this symbol and to this extent it would be a meaningful kind of thing.

S: Just as there is meaning of a kind in music.

C: Yes, it would be the same kind of thing wouldn't it?

S: Although I have "meaningful" under semantic information, don't take it too seriously. That is, there is a special kind of meaning in each kind of information.

C: Semantic meaning is verbalizable. I think this is what we are trying to get a hold of.

C: I think the very nice thing about the model is the way it emphasizes the place of evaluation in the process of self-regulating and self-generating.

S: There is self-checking right along.

C: Yes, it becomes the essence of learning, of problem solving. And this is encouraging, I would think.

C: Doesn't it suggest that we have to do things much differently in the classroom so that evaluation becomes part of the process; I mean self-evaluation and self-testing?

S: It means that we must emphasize feedback processes more.

C: Well, yes and invite more feedback from the individual himself.

S: And teach him how to use it.

C: Yes.

C: How to find his own mistakes rather than depend on others.

C: Yes, so that you have found out upon what he has based his decision. You know, where it came from.

C: But the fact that the student evaluates himself, the teacher doesn't evaluate the student. Maybe the teacher just peaks in on the evaluation and then fools with inputs 2, 3, and 4 and so on. She has some means of ingress. She doesn't evaluate the kids, she just looks in to see how they evaluated themselves and then maybe pump some more into the system.

C: Ok, ask him how he got his question, but in a nonthreatening way so he can really evaluate or look at it. Spread it out so he has some material then which he can evaluate. By the time he is through he sometimes knows what he did and why he went wrong or right.

C: I had an interesting thing happen with a student once after we had done some brainstorming on a particular problem. He said, "Now I got a real interesting idea" and the problem was with respect to how to study. This was what he was working on. He had a very wild idea that was actually an unethical idea but it would have gotten him somewhere if he wasn't concerned about ethics. He said, "Now what do I do about this?" He turned to me sort of smuggly and I turned right back to him and said, "Well now what do you do with it?" And so he thought about it for a while and then he said, "Well, I get your point." But he thought he was going to corner me, that I was the one that was going to evaluate this.

S: You'd be his consicence.

C: Yes.

C: Had you answered him, that would have come in as another form of input, wouldn't it? That would be evaluation from an external source.

C: Don't you think at the present time we are kind of drowning people, our kids in our classes with inputs? All they can do is keep their heads above instead of going through the very natural processes of thinking and learning.

S: As I say students are not given enough need to seek their own information.

C: Rugg speaks highly of some of these earlier stages such as figural-behavioral things which are less abstract developmentally, and also mentions that abstractions come in earlier in the developmental sequence.

S: Rugg's point may refer to the Piaget idea that we learn first about concepts through manipulating and feeling, in connection with manipulation. And there may be a need for a feeling figural category as well as auditory and visual categories. One of my students (Stephen Brown) has carried this kind of thinking further. He has taken several of the senses and started to build a model parallel to the intellectual model. The two models are not quite parallel, but there are six categories. In some respects, these categories resemble some of Titchener's old dimensions of sensation. There are two space dimensions; however, one being direction, and the other includes everything else in terms of space, shape, texture, and other properties. And there is a time dimension. And then there are three that correspond to the traditional qualitative dimensions. Representing these, in vision there are three known factors of color sensitivity (red, green, and blue sensitivity) and in addition, there are three categories of sound sensitivity, for high-frequency, middle-frequency, and low-frequency stimulations. Whether this kind of three-way analysis will apply also in the other sensory areas is not known.

C: But I think this point is basic to all theory of learning the point that we can get information from the environment, the extra receptors and then from the intraceptors the gut feeling sort of thing you are talking about.

S: This proprioceptive area is another figural area that should be considered.

C: It seems to me that a problem does not necessarily have to be in a semantic sort of form. I think all the creative artists have this problem of arriving at something that may be not formulable, not stable. They may go through this matter of production and evaluation. We asked an artist friend of ours how do you know when to stop a painting. He said I stop it when it is finished. This was the best answer he could give, maybe the need to arrive at some conclusion which is not defined in advance.

C: I wonder if he doesn't have subconscious criterion in his mind.

C: I don't know that the artist would know if his painting was finished or not.

S: Is there a common feeling of "being finished?"

C: Artists report it, but it covers different things.

S: What one of them would call finished another would not call finished?

C: This has truly been in our feedback operation when we feedback a person's processes to him. He will often say, "Ah-ha, I should have stopped there," which means his feelings ought not be trusted Because if he would have trusted his feelings, you know that's where the thing is, but then he thinks, "Gee, what I wanted was really more like this."

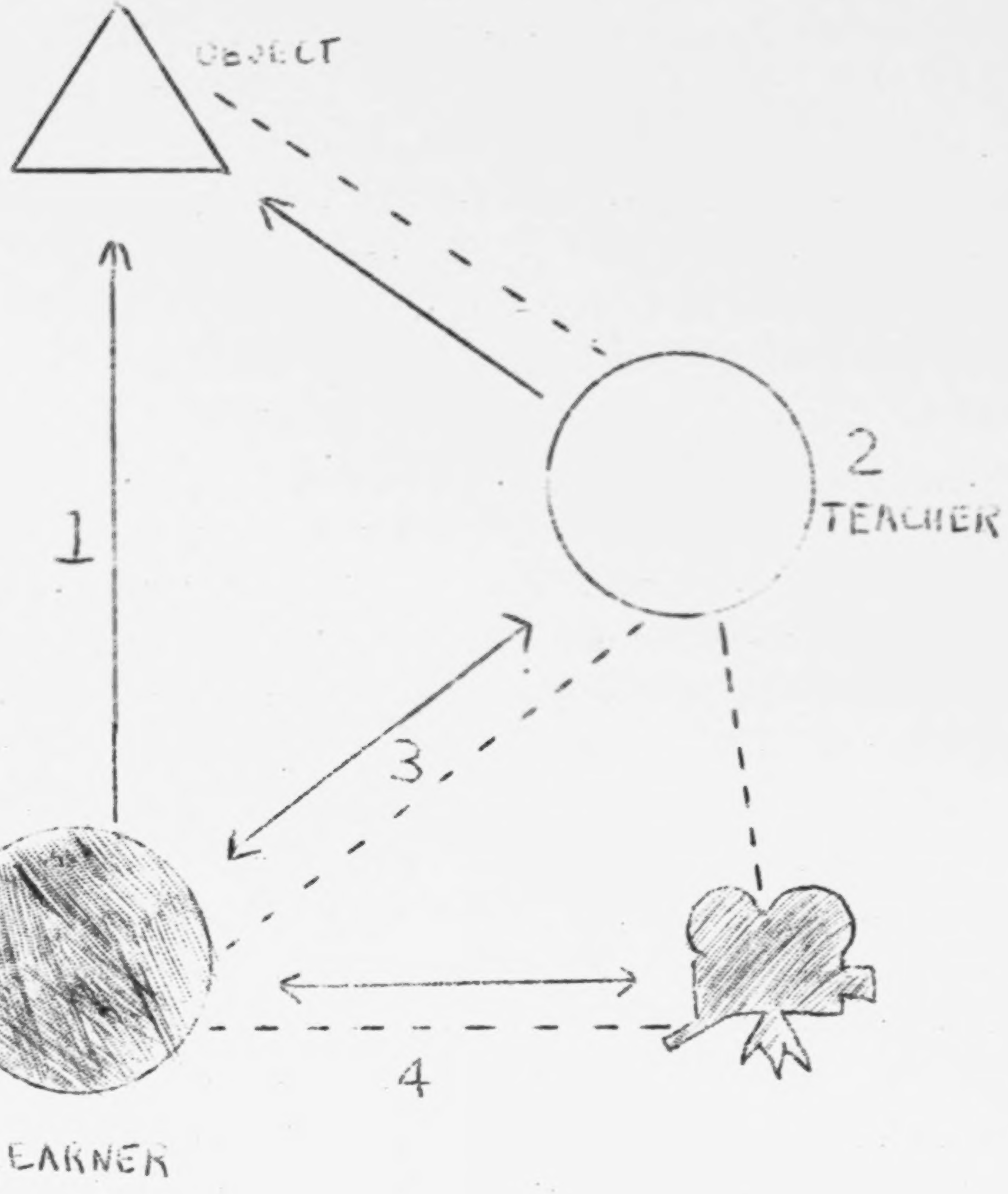
Chapter 4

Existing Instructional Media in Relation to Creativity

Jack V. Edling
Teaching Research Division
Oregon State System of Higher Education

S: Let me begin by admitting that I find the subject of creativity difficult to discuss with any feeling of confidence. I have here certain tests which can be used to operationally define creativity, and if certain responses to these test items are what we are talking about, I feel that the subject is somewhat more manageable. However, I suspect that there are those among us who are thinking about behavior other than that measured by these tests. For example, some people think of creative behavior as novel behavior that is socially acceptable. Whether novel behavior that is socially acceptable by certain groups in our society is related to behavior on these tests is unknown to me even after a rather extensive review of the literature. However, my assignment is not to discuss the criterion problem but rather to relate existing instructional media to the topic of this conference. My purpose in bringing up the criterion problem is that it is of such great concern to me that I cannot pass to my assignment without first expressing my uneasiness and making it perfectly clear that I have serious reservations about the behavioral manifestations of what we are discussing.

With reference to the other half of the topic--instructional media--I shall define these as all indirect means for providing learning experiences with the exception of the classroom teacher, who provides both direct and indirect learning experiences for students as I shall define the terms "direct" and "indirect." This definition will require further explanation. This simple diagram may be helpful.
(See Figure 1)



OBJECT
2
TEACHER
1
3
4
LEARNER

FIG 1

A learner may have direct experience with many objects, including instructional media and classroom teachers (represented by the solid lines numbered 1, 3, and 4), but these experiences are not defined as instructional media.

C: What's the difference between instructional objects and media?

S: Instructional objects refer to either physical or psychological things that we're teaching about. For example, the Civil War, longitude and latitude, any event, idea or object. I am calling these the objects of instruction. And a learner may have direct experiences with many of these things, and with teachers, and with media. Theoretically, at least, every educational objective involves a learner, an object and a relationship between the learner and the object. The object may be physical or psychological. Thus, an objective might involve a sixth grader and poison ivy. The relationship might be that the sixth grader should avoid it, cut it, or warn others of it. Or the objective might involve a sixth grader and the concept of longitude and latitude and the relationship might be that the sixth grader should define, identify locations, or in some other way manipulate longitude and latitude.. The learner could learn the desired behavior through direct experience with the poison ivy and perhaps with the aid of his teacher. But, longitude and latitude are abstractions which either the teacher would have to explain or the child would have to learn from some insructional media. The learner's experience with printed, photographic or recorded material on longitude and latitude would be a direct experience, but the relationship with the concept of longitude and latitude would be indirect in that the person who prepared the media explained the concept of longitude and latitude not directly to the student, but indirectly through the medium of a book, film or a recording. Thus, I shall define the term "instructional media" as all indirect means for providing learning experiences with the exception of the classroom teacher who may be the most effective instructional media of all, but for purposes of this paper is arbitrarily excluded from the definition of instructional media. The most common instructional media are books, films, television, motion pictures, film strips, recordings, kinescopes, videotapes and most recently programmed materials of various kinds.

Existing instructional media, obviously, vary greatly with respect to their quality, originality, completeness, etc..and, because I am uncertain with reference to the criterion, and because teachers interact so differently with media, I do not feel that the relationship between existing instructional media and creativity can be appraised very adequately. I have no evidence, for example, that because a child learns through materials which are considered creative in the opinion of experts that the child will be any more creative than if he had learned the same relationship with the object through media which expert opinion said were not creative. Of course the position may be taken that certain relationships, such as creative behavior itself, cannot be learned at all except through very creative instructional media. If this is true, I believe that the characteristics of such media are still to be defined and the evidence for such a position is still to be collected.

It is my opinion that if this topic is to be discussed realistically, one must look at the present situation in an economic context. There are certain economic realities that are probably the prime determiners of both the content and form of existing educational media. These economic considerations may be operating in opposition to practically everything that is known in a scientific sense about the production and use of instructional media. As one example, let us consider educational films. As a kind of rule of thumb, the minimum cost for producing an educational film is $1,000 a minute, so if one were going to produce a fifteen-minute film, he would consider a minimum budget of $15,000. When the film has been completed, the cost of reproducing it will total about $15 per hundred feet when the container and the overhead costs are included. Since 100 feet of film runs approximately 3 minutes, it will cost about $75 for each print of the 15-minute film which has been produced. The film may be priced for sale somewhere between $150 and $200 per print. However, the cost for selling and distributing the film will reduce the net profit to perhaps $50 per print. Because there is a $15,000 first cost, which must be recovered before any profit can be realized, at least 300 prints must be sold just to recover the initial investment. Since there are usually many other indirect costs and taxes in private industry, it was a fact, just a short time ago, that at least 500 prints of any film had to be sold just to keep the company solvent. Now this educational film business is competitive and prior to NDEA, at least, and perhaps even since, selling many hundreds of prints of films to schools that do not even have adequate books and other essential supplies was not an easy task. So film producers have tried to produce films that would have very broad appeal. They have advocated the "multiple" and "creative" use of films. A given film can be, in their view, used for "enrichment" in grades K through college, or almost that wide a span, and in several subject matter areas when used by a "resourceful and creative teacher."

I recently previewed a film by a major producer on the general topic of the sea. The photography was beautiful. The narration was at least acceptable prose. The producer stated that it was one of their most successful undertakings; that it had been used for various purposes by elementary, secondary, and college teachers; that it had been used in art, science, English and the social studies.

For a number of years I have been trying to determine the effects of various kinds of educational films. The evidence, as it came from various kinds of tests scores, is not very supportive of the general philosophy and position which I have just described. I have been led to the general conclusion that for a film to have any measurable and predictable impact on the behavior of the learner, (1) a great deal must be known about the characteristics of the learner, (2) in order for the film to modify the learner's behavior the content and method of the film must be congruent with certain of those learner characteristics and (3) the film must be very carefully prepared and extensively revised on the basis of empirical evidence collected on the intended learners. Even so, it is a rather crude trial-and-error business. Films produced under this rather expensive and time-consuming procedure are only effective with a very limited number of subjects. The little evidence I have leads me to believe that at a given grade level, in a given subject matter area, and within that subject matter area for a given specified type of behavior, perhaps six or seven different versions of a film would be needed to produce measurable changes in either intellective or nonintellective components of the behavior of a major portion of the class. Because of my very limited insights, I hope you will forgive me for concluding that many educational films may be described as kind of a Rorschach experience from which almost any kind of behavior might be shaped by the "creative" teacher. Of course, I don't feel this is particularly bad because we educators have never really defined the kind of behavior we are trying to teach anyway so these materials are ideally suited for our purposes.

On the other extreme is instructional television. I say it is on the other extreme only in the economic sense, and even that is not accurate because the continuum of costs is seriously truncated at the higher end. The most typical time pattern for instructional television is instruction which will fit into existing administrative patterns. Since the usual class time is 50 minutes, instruction is normally planned for that length of time. The budgeting varies around the country but the pattern for production costs is approximately $50 per class in many places. Incidentally, that is not a minimum figure as it is often much less than that. Fifty dollars for 50 minutes, of course, results in a cost of about a dollar a minute for production purposes. While this compares rather unfavorably with the $1,000 a minute for film, the television medium comes from a different tradition and, like its sister orphan, educational radio, it is rather used to a starvation diet. It is also most familiar with the audio channel and, in most instances, relies most heavily on it. The lecture and the "talking face" are the most frequently televised objects and there is general dissatisfaction, especially among television people, about the use of the video component of the medium but the economic realities have largely, at this point, not been faced.

Obviously, I am not suggesting that there is a one-to-one relationship between the cost of producing instructional material and the effectiveness of that material in teaching creative behavior. But, it seems reasonable to speculate that there is a relationship between the amount of various kinds of talent that produce a learning experience and the effectiveness of that experience.

Since talent is frequently in demand it usually has some economic value and therefore, products consuming larger quantities of talent frequently cost more than products consuming little talent. My main point, however, is that (1) even if we are successful in defining the behavioral manifestations of creativity (i.e., instructional objectives stated in measurable terms) and (2) even if we are successful in identifying the kind of learning experiences needed to attain those objectives, there are still several major remaining tasks before us. Those tasks include (1) obtaining lay and professional acceptance of the goals and means-to-goals we have invented, and (2) somehow creating the conditions that make it possible to produce, distribute and utilize the instructional materials and media that teach the desired behavior.

Another example can be found in programmed instruction, which was coming along fine until someone started actually using programs and then, of course, the pall effect and the discomfort in changing administrative procedures to accommodate the new medium made it quite unacceptable except, of course, for the usual "enrichment" programs which are so necessary in modern education.

We recently undertook the evaluation of a short commercial program and utilizing acceptable research procedures, including the development of equivalent forms of a criterion instrument to provide for pre and post-testing and a rotation of tests, control groups, item analysis, and all other generally accepted procedures, learned that even on a rather short program, there was a $1,500 investment needed to collect and process and report data on about 100 subjects. We discussed the findings of the study with the publisher of the materials and attempted to negotiate support to evaluate other products that he was producing. I suppose it is unnecessary to relate that our findings disclosed certain deficiencies in the product and that the offer to serve as an independent testing agency was not accepted.

I want to be the first to state that there are many exceptions to the remarks I have just made. In film production, for example, some films are produced with definite purposes and definite audiences in mind. Dr. Lester Beck is one of those exceptions, but his films have been supported by an independent foundation that is not totally dependent upon sales for its existence. Likewise, I have seen television lessons which were exciting because of their clarity and freshness, but unfortunately there have been very few attempts to analyze, systematically, the effects of either these programs or those which are more typical of the television medium. The present procedure for evaluating programmed materials is largely one of teacher analysis to determine the relevancy of the content of the program to the objectives of the school. Dr. Rothkopf from Bell Telephone Laboratories made a little study of the effectiveness of this process and collected evidence which indicated that there was nearly a perfect negative correlation between teachers' opinion of the effectiveness of a program and the actual learning from the program as demonstrated by student scores on criterion measures.

I suppose one would conclude from what I have been saying these past few minutes that I am very critical and hold little hope for existing instructional media to contribute significantly to the development of creative talent. Actually, nothing could be further from the truth. I believe strongly that when we do identify the kinds of behavior that are involved in behaving creatively, that this kind of behavior will be best taught through instructional media and I think I have some rather substantial reasons to believe that this will be the case.

In the first place, new techniques are emerging to aid in the study of educational media. The techniques being employed by Egon Guba and his associates at Ohio State in the analysis of the visual patterns of students actually viewing existing educational media and the new processes for analyzing these visual movements holds great promise for refining and developing media for instructional purposes. I think that the work of Schalock, and Beaird, and Siebert in developing new kinds of visual tests holds great promise for both assessing certain kinds of learner characteristics and measuring the outcome of all kinds of learning experiences in a manner which is much more refined than those being used at the present time. I think that new theories of instruction relating to modalities which are being discussed by Travers and Maeger and others will lead us to ask much more meaningful questions than we have in the past. Further, new methods are being devised to utilize educational media once they have been developed. The simulation techniques of Kersh, where the learner does not respond either covertly, passively, mechanically, or verbally to media, but is confronted with a situation where the kind of behavior that is intended to be taught is actually practiced, holds great promise for teaching the kind of behavior that might conceivably contribute to an increased ability to create new relationships in our environment.

On this general issue of the use of materials, it was my understanding that most people who have actually created products that are considered creative believe that there is more involved than divergence of thought. As I understand it, there is almost always a recognized need for some new product or approach or process. In addition the individual, or individuals, have great intellect and motivation, and spend considerable time wrestling with the problem and potential solutions to it. Often there is a period of relaxation or rest from direct concentration on the problem where some sort of synthesis takes place of all the separate factors relating to the problem. Also, there are often many supporting inventions or creative thinking by others that contribute to the new product or concept that is considered to be creative.

It would seem reasonable to me that instructional media could be designed and produced (1) to identify needs and, (2) to communicate those needs with considerable impact on our young people. The great problems facing our society and the unresolved issues requiring a creative solution could be made of immediate concern to students who appear to have no concerns at present. In other words, media might contribute to the realization of need by more people. Secondly, I would think that instructional media could make clear the kinds of extended and extensive efforts that are needed to find and invent, or discover, the kind of creative solutions necessary. The conditions under which creative activities have occurred in the past, and other behaviors and conditions which have contributed to creative behavior could be made clear to these students. And finally, it would seem to me that instructional media would be invaluable in communicating supporting and relevant information that would be needed as part of the input to creative behavior, provided that there was some awareness of the kind of knowledge that was relevant and supporting to the kind of creative efforts that were desired. Now, to my knowledge, existing media have not, or are not, being designed for these purposes, specifically, and if they are being designed, they are not being evaluated scientifically for their effectiveness in achieving these ends and objectives. Hopefully this conference will tend to rectify this situation.

C: One comment is that you indicated that there wasn't as much of this really high-level talent needed to produce films or things of that sort.

S: Oh. Did I say that?

C: I got some impression that this is a rare commodity, an extremely valuable commodity.

S: I must clarify that what I meant to say was that commercial films cost about a $1,000 a minute while T.V. and radio in education has support of about $1.00 a minute. Perhaps, while there is no one-to-one relationship between the cost of the product and its effectiveness, it seems reasonable to conclude that when you put a lot more talent into the thing, it's going to be a little more effective. Finally, that more talent is going to increase costs so there must be some sort of relationship between the cost of various media and their potentialities for instruction--providing the talent is really creative in the area of instruction.

C: There might be quite a creative experience in a person who is producing a film for example or a T.V. show. That doesn't guarantee that the child or the learner has any kind of a creative experience in being exposed to the final product. I think there might be quite a different experience in the manufacture and production of it than in the receiving of it. And you also told us that teachers as a group may not know what things in the film have an impact on the student. Now do we have any idea that the people who produce the films who have these creative experiences of their own know what cues and clues will produce the kind of desired experience for the students? This is still in our "you-don't-know" category.

Their experience in producing may be a rich experience for them but the richer it is for them, for all we know, is that it may rob the child of richness of experience.

S: I have no evidence at all. I'm just kind of hoping that this kind of thinking is a little bit reasonable, i.e., that the more creative talent that goes into the production of a learning experience might hopefully, somehow, elicit a little more creative behavior from students. But, I have no evidence to substantiate this.

C: May I comment on this one too. It seems it isn't necessary for a film to produce creative behavior in a child who is watching it in order for the film to make an important contribution. The ultimate is the creative thinking and activity of the child. For example, it may only be a very artistic presentation of material from some valuable, stimulating, and exciting input. All you are getting is input in this film. But never the less this may be tremendously important to what the child will ultimately get out of it in the way of creative activity. So I think we ought not require too much of any particular film in that it gives the child whatever you mean by creative behavior or creative experience.

C: I was trying to indicate that one shouldn't make any where near an assumption that the nature of the process by the persons producing a film, for example, behind the scenes, and the process of the teacher, the teacher's behavior, or whatever the teacher does necessarily means there is going to be the same kind of experience in the recipient. This is what I'm saying at the moment. All you're saying is that it may be a contributer at a later date. We are trying to point out that we have a very rich creative experience on the producer and it may be a very hum-drum experience to the recipient and maybe vice versa.

C: I think that you have a very sensitive point here that the educational film producer, when he's writing his script and designing the film may, to be sure, have children in the back of his mind as he is working out the vocabulary level of the script, or something of that sort. But, in the front of his mind he has the audio-visual director and the curriculum supervisor because they are the ones that buy his film. These are the ones that sustain him. It isn't the children. They don't buy. But the film producer has got to design things in such a way that it'll please this audio-visual director who will buy 35 prints of his film--providing he likes it.

C: And the producer may not know the cues that are important to the student for learning.

C: So that you have the phenomenal situation that the education film producer produces not for the person whose learning will be effected.

C: Or how will his film compete with existing films on the market.

C: May I raise a question? Since really I am not at home in this field at all, how much is being done to identify some of the unique things a film might contribute? For example, I was just thinking in this process of the producer as a creater versus the receiver, it occurred to me, because one of the things I have enjoyed occasionally on TV is the drama that there have been some very effective dramas produced. And I was thinking that one of the things that a film could do with using dramatic material may be making video tapes of some of the fine things that occasionally occur in order to extend the range of the presentation of emotional response. One of the things that Jennings and Mareno have said is that when human beings develop and interact with others they become aware of this wide range of emotional response. As they interact with others this whole range of emotional response is also benefited. Now it just occurred to me as we were talking on creativity that this would be a whole area one could present through drama. You see, it wouldn't matter which emotional responses one picked up at what time. If you had a series of dramas during the lifetime of a youngster in school he could be exposed to quite a range of emotional response that might take for some youngsters.

C: This involves the perspective that we have in the affective taxonomy which moves at least away from the cognitive domain which hasn't been satisfied either. There has been some debate as to whether it's organized the way it comes out or whether there is a hierarchy of interests, attitude and values.

C: But the interactions are inter-related. They are only separated for our convenience. I mean we separate them.

C: The objectives have been ignored by now.

C: But if we could broaden the objectives of materials then we would increase the range. I don't know, I'm kind of excited about that.

C: I think that is a good point.

C: I am somewhat puzzled here by the speakers discomfort that a piece of materials could be used successfully in art, in science, and in many fields. This doesn't seem to me to be ridiculous at all. In some of the materials we have been creating we have deliberately suggested that they may be used in many ways, i.e., in geography this way, and this way in history, and this way in language arts, this way in art, this way in music, and so forth. So when you have an artistic product as this apparently was I can't see why it would be ridiculous for it to be used with a high degree of success in encouraging creative behavior in a number of different fields.

S: Well, my only answer is that when you identify the kind of behavior you are trying to teach and that when you use those kinds of non-specific materials, at least the research I have done in this indicates that the materials generally have no measurable effect on the behavior of the learners--unless the materials are geared specifically to certain known traits of the learner and was related to them. Specifically, only then will the media communicate with some sort of impact upon the learner. What is very satisfying to the teacher, what has been a wonderful emotional and moving experience to the teacher may have little affect on the learner. We made some films that were right down the line of interests of high school kids , we thought. It had a hot rod in it, and other things that kids were supposed to be talking about. I was in the audience in the auditorium, viewing with these kids, and there were a couple of fuzzy headed girls in front of me and one of them turned her head and stuck her face into the mess of mushy hair of the girl next to her and all during the film they never once looked at the screen. They were just whispering back and forth. As far as a learning experience being provided by the film, dispite the fact that it was theoretically, psychologically near to them, it had no discernible effects at all.

C: This must have appealed to boys and not to girls. It is asking too much of any film or any medium to appeal equally to all individuals. All psychologists are aware of the fact of individual differences. This may complicate the problem and mean a variety of different kinds of films for different students in a school, but it seems to me this is no reason for having as much dispair as you're expressing because a couple of girls are not interested in this particular film.

C: I think your concern is justified anyway when you depend automatically upon a piece of instructional material to accomplish a goal. No matter what you do, I think you are automatically doomed to fail if you expect the material to do it all.

C: When you say there is no measureable difference in the two approaches to instruction, a lot depends too on the kinds of tests you use to detect this difference. I think maybe other differences are not detected at all by the tests that are used.

S: That is the purpose of stating objectives or identifying some sort of outcomes that you expect for the child. I advocate that there is no such thing as a learning objective. Any time we're teaching a student to do square root, for example, I strongly believe that we are not only teaching him to manipulate numbers but we want him to learn, at the same time, a method of learning. We want him to learn certain attitudes toward the subject, we want him to learn certain attitudes toward the methods of learning. I mean there may be four, five, or maybe ten objectives occurring concurrently. But, at the present time, at our present level of sophistication, it seems to me, that we ought to, at least, seek some sort of measurable effects on the objectives that we do specify. And when we say that we are trying to teach a child square root, and as we finish if he can't calculate or determine the square root of a number we must conclude that if he can't demonstrate this, that he hasn't learned it.

C: I would agree that if we define our educational objectives in cognitive terms then it is rather silly to expect creative material to suit the English program, the science program, and the mathematics program. But if we define our objectives in some broader terms, some concept which has some broad frame of reference then it's entirely possible for us to have these multiple purposes.

S: From a research viewpoint, I don't care what the objective is. As I have said before even if there is no specified behavior at all, as long as you define this as your purpose and then can demonstrate in some way that you have or have not achieved any of this goal, as long as you have arrived at where you said you were going to arrive, then you are not deluding yourself about your teaching effectiveness.

C: For years we have defined our objectives in very narrow cognitive terms and that is what your public, your market, is buying. That's the base on which they buy the film I think, i.e., a science lesson as a magnetism unit in my science course.

S: The thing that is most intriguing and most useful to me is this work that I mentioned at Ohio State. They have devised a kind of moving graph where the result is data in the form of a picture of what the child is looking at. It might be a motion picture or television but there is a dot on the screen as to where the child is looking, a light dot, so there is evidence of what a child is attending to. They have evidence now that indicates that a person teaching on television may bring on an object, an audio-visual aid, and as they are describing it the child's eye may be focused right on the teacher's mouth. The child's eye may never once even move over to the visual aid that is being displayed. And sometimes with certain bright learners, the learner may not be concentrating on the audio portion of the film, apparently they are looking at the teachers clothing, looking at objects around the room, or at the background. They are attending to all kinds of irrelevant stimuli, they are getting information about the setting, about the teacher, about miscellaneous objects around the room and they are acquiring information at a rate so much faster than the instruction is intentionally putting out information that they eventually appear to sort of "tune him out." It is still very exploratory research. But often the eye pattern even wanders right off the screen. I'm certain that some of this wandering takes place when the instructor is most eloquent and when he is most content with himself. This wonderful evidence just shatters all of our really cherished notions about how effective we are as a lecturer and as a teacher.

C: This does not prove that the person isn't getting something when he isn't concentrating on the person while listening to a lecture or closing his eyes and not listening to the speaker at all. There are various ways in which students react to material being persented I think there are individual differences in ways in which material is taken in and what is done with it.

S: Of course, this is Travers point now. Travers is advocating essentially that the learner is a single modality learner. That the person may oscillate or switch channels very quickly. Guba and associates have evidence to indicate that if the person is primarily attending to cues from the audio channel he is concentrating on the mouth of the speaker. That's where many of the slower learners will be concentrating. The reason probably is that information is coming in at a slightly lower rate on the audio channel, at least the cues are coming at a slower rate.

C: Essentially, I think what Travers is trying to prove scientifically, is that we have been overloading all channels on any type of sound motion picture film for years. By overloading irrelevant data a viewer can't attend to all of this information at once. Now with the light meter in Guba's work he is attempting to show where the child is concentrating on the overloaded circuit.

C: If you have a slow learner or a person who is rather dull witted I think he may have a very circumscribed and narrow field of consciousness having to focus right upon the lips of the speaker. But I think with a brighter child, a child who is able to take in more at any one time you are going to have this wandering phenomenon.

S: For him the information probably doesn't come fast enough so that he seeks other sources of information about the person, about the room, everything else. At least, you could read that into it by looking at the evidence that is accumulated on these kinescope.

C: Has there been any relation on these studies of responses to information to I.Q. or other personality characteristics?

S: That's some of thepoint the way we are describing it now that there does seem to be a relationship. The apparent searching for information is related to I.Q. I mean, human variability here is so much broader than is commonly perceived. Again, the research of Siebert's that I alluded to very briefly is that he's developed some new kinds of visual tests. I wish you could see them on the screen. There are objects moving in space. There are four of them moving simultaneously. One of these objects is different and you are supposed to pick out that object in a fraction of a second. As I looked at the film, I did not even have time to hardly scan the film. These are individuals however, who can pick ten our of ten of these. They obviously have a characteristic that I don't possess very much of.

C: I have done some research on human characteristics also in my teaching of human engineering. We have a hunch that if you started early enough with youngsters and trained all of their modalities, you'd find multiple ones through which each one would function quite well and that we probably are not using this resource and I'll bet it isn't too highly related to I.Q. We should train youngsters to use the broader channels early enough before they get highly patterned in their mode of learning. This would be my hunch. We are not training them to use multiple channels of input nearly as effectively as we could. It is pretty hard to swamp a human being. You can swamp the ear by saying more than two or three messages simultaneously but by getting the right kinds of singnals you can send two or three simultaneously and you have all kinds of other modalities as well. A human being can fluctuate his attention and juggle a lot of things at once.

S: Travers has quite a bit of physiological evidence, too. A man down at the University of Mexico, Hernandes Poen, has also collected evidence on sub-human species. The evidence suggests that information may be coming in but there is a control mechanism which tends to give primary attention to one modality. According to Travers this man's evidence is fairly substantive.

C: Well, it's certainly true in some settings like in a pilot's setting that they send messages through multiple channels and the pilot seems to be able to manage them. What you're saying is that at times attention focuses on more than one modality while the other one gets lost in the process and he has to re-awaken himself to keep the balance. We have a lot of situations like that in which people do get stuffed through multiple channels.

C: When you are working in classrooms you do have an interesting phenomena, mainly, you have some youngsters who are always out of field, I mean they are always doing something and the teacher stands up for a while and then attempts to catch them as it were, by sending a question to them or asking them to respond. I have been interested in children, who are doing a hundred and one things and you can keep a record and maybe they were doing twenty-five things none of which were legitimate in terms of the rules of the game, such as the reading lesson or whatever it was. The teacher did this, shot questions to them, and the kids raised their heads and answered the questions. Then you get a very real reaction on the part of the teacher, usually the teacher is angry because this is not what she had expected and she is shocked then with the youngsters. We have studied this phenomena as a specialized kind of thing, and so you can't tell me that human beings do not do a number of different things and still pay attention.

S: I don't know if your evidence is conclusive or not, because it may be that the information that was needed to answer the questions that had been previously learned by the person.

C: Alright, but this is the same thing in looking at a film when you talk about single channel for groups of people or when you talk about any message to a group of people. You have no idea to what degree different members of the group have some information or what small cue is necessary to get the correct answer. This is what I think we are not taking into consideration. This internal experience, this internal processing and combining and expanding of information that an individual does is so important.

C: I had a girl one day who was reading a magazine all during my training sessions and I talked to her afterwards, and she said, "Oh, I was listening whenever you had something to say that I didn't know. I listened to it." I know that she was skimming listening and I have every reason to believe what she said. I checked this out and I think she really did listen and she was able to concentrate.

C: I think I have an explanation of why people concentrate on the lips of the person, when he appears in a film. Isn't this testimony to their efforts to try to find out who this significant person is, or how this significant person presented to them is composing his world. You have not only a distinction of range but you have an integration to accomplish too. And in a sense what the mouth supplies is a center of realizing that it is the integration of all that appears, and so we humans try to ride piggy back on one another's mode of composing.

C: It may be lip reading to augment auditory information.

C: I think it could be that, but I think it is deeper than this in the sense that we do learn from one another. That is we humans have comparable psychic functions and we communicate with one another by trying to get our centers of ordering relevant to the centers of ordering of that other system that is harmoniously built.

C: Jack, can I ask a last question and then maybe we ought to move on. I wanted to get some impression from you,as to how much hope do you have for existing media? When we are talking about creativity, does one have to get a lot of new instructions to teachers on how to use media effectively?

S: I think this relates to Torrance's point about existing media. There is no question in my mind that they have some potential, for some purposes, for some students. But we don't know at this moment, I don't think what the purpose is or who the students are. And until there is some sort of testing some engineering done on this particular thing it's kind of like a Rorschach. It's a group of stimuli that are bunched and packaged together. I think it was mentioned yesterday that testing and experimenting with some films led to their more effective use. We do not know what films are most effective at the 5th, 6th, 7th, 8th, or 9th grade levels. By experimentation it has been discovered that for the purposes that one group had in mind one film was most effective at the 5th grade, etc. It seems to me that if you go through this kind of a testing and engineering process that there may be great potential in existing media for certain specific purposes for certain individuals but we don't know what those are.

C: By the same token, you don't know that we know very much more or how to build new media that are any better.

C: I don't see any concern, as long as we recognize that what we have existing now is an embellished and enriched mass of experience to stimulate the viewer. But I think we have to be careful and point out that Travers, Broadbent, Carpenter, and Dale, and all of the other new media people have been talking about for several years now. Their concern has been one of a specific information transmission devise for example on how to learn to tie a knot or to learn how to take the gun breach block apart, but not something generalized such as how do you appreciate nature. I think you go back to the very basic objective of what this film really should do, is it to develop a specific trait or ability or is it merely an enriched input to provide motivation. Everything that we have been doing with Travers has been done with nonsense syllables, three letter nonsense syllables, as bits of information. And this is what Broadbent has been talking about. This is not learning through enriched inputs as a part of experience.

C: Well, in our educational theory that has been passed around we indicate that we ought to be concerned about two things at once. These are what content is being learned and what kind of psychological experiences or processes of thinking are occurring in the student while this content is being learned. And so we think that these might be equally important rather than focusing solelyon the content. For all we know, if they want transfer of training, which I think is spread effect and which is the real thing, I almost would bet more on the process of transfer than I would on the content.

C: Isn't it true that the image that arises when we talk about instructional media is one that is excessively general and passive and with externally defined problems, which is completely opposite from the context of Guilford's problem solving model which comes back to another internal evaluation of in-puts that only have meaning on top of a psychological-individual base. Why should media like films do any better than books? Books are so much of an in-put in one way that they have to be utilized in some fashion, and yet we have libraries and students who don't make any meaningful contact with this rich source of in-put material. The input is highly individualized, as I see it, and the cost of films and the other aspects of such inputs are immaterial.

S: I would buy about eighty percent of that with one great exception.

C: That's what I expected.

S: Alright, fifty-five percent then. I don't want to go past your expectations, but I do think that while we postulate these great individual differences, and they're no doubt there, Allport said this better than anyone, that whatever is consistent and enduring in our society is consistent because there are common values, common interests, common goals, among many individuals. Now we are not all the same, but there are enough people who share a particular viewpoint or value so that all individuals aren't totally different from each other.

4

C: The individual has a filter through which these activities change behavior but I think this is highly idiosyncratic.

S: Well, except that I think that there are groups of individuals who share the same kind of idiosyncratic things that you're talking about. There are people who like the same kind of art that you like. There are people who have generally the same level of intellectual development, there are individuals who value the same kinds of things. And this group of individuals can have a learning experience and after the experience can demonstrate behavior which is quite comparable. You can demonstrate this. There is great variability but we also find certain commonalities.

C: Are you saying that as the image goes, as the emphasis goes over to media, you loose that side a bit and we begin to think of what media can do and what the reaction to it as a guiding force can do?

C: Wouldn't you say that processing information and so on could be quite idiosyncratic with the behavior that we see in the thing? I just don't think I quite believe this kind of similarity in one's processing. I think that maybe there's another level of communality here or something but I think that processing and so on is much more idiosyncratic than we think.

S: Well, the only thing I have to go on is the evidence and the evidence in the form of responses to various kinds of test scores indicates some common patterns of responses.

C: Well, I'm talking, I think the end product that can look the same. But I'm just saying that I think that the processes toward that end product may be very different.

C: I think we should over-generalize in this sense that the media provides considerable redundancy of presentation information a lot of which is probably unnecessary. We have to determine what it is in this situation or that situation which needs an increase in redundancy in order to assure the same in-put to everybody.

C: There is commonality in a sense that the human being has openings through which traffic comes. A human being has the necessity for composing an integration of experience as it occurs to these openings. He has these sequential transactions that continue during the course of the film to maintain his integration and his openness, and he has fittings which form and which come to be composed as his learning or as his experience. So **though** there are differences in the sense that you can become aware of how differently the process goes. Is it not true that the process inexcapably has the same basic necessities in it because the mind and the human being is composed as a system? And this sense of a common system for all men is the source for the leading question for research concerning how he operates.

S: At least that's a practical hypothesis. It's one that enables you to work with it. You could do something with that idea.

C: Then you see differences among people because you have a common ground in which to note the differences. If there were no common ground against which to note the differences you wouldn't be able to note the differences.

C: There could be a common ground if there is an idiosyncratic base to start with. That's a common ground too.

S: That's not very heuristic though.

C: Well, I don't agree because I have been studying and I think things can be made heuristic which are not so. In other words, I believe in science.

C: The speaker is being a little modest with us this morning because his own research indicates pretty clearly that if you go out and analyze the needs, study the needs of your target audience and then build a message consistent with those needs, your message can be very simple, very direct, and the results indicate that it is very effective. Where as if the message falls on the ears of another group with a different set of needs, there is no effect from the message. Now, I think what he's told us is that with educational films we don't use this precise, single shot method of his and we don't hunt with a rifle, but instead we hunt with a shot gun. Most of our educational films try to cover a wide area hoping that one shot or two shots some way or other will be able to get through. I must say that I have a great deal of sympathy for what he is trying to do in refining the techniques with which we do our hunting in the educational field. But many of us are at a level where we can't use his refined technique and the educational film producer really is not a very good marksman. He is an extremely poor shot, and so he uses his scatter procedure primarily because of his ignorance.

C: Back to my point where I said that we are really after some kind of spread effect and the way you get your spread effect is if you want to think of it as a drawing in on the most basic target or something. You may be getting a rifle shot in terms of content, but are you getting a rifle shot in terms of the process that the youngsters are having?

S: I think this is particularly a matter of identifying what objectives you have in mind. If your objectives are processes you can get a rifle shot on processes as well as on content.

C: Can you get a rifle shot simultaneously if the core of both matters, really if you are after spread you want to maximize your spread by playing both games or at least alternating one to the other and knowing what you are doing.

Chapter 5

Some Personal Observations on Creativity

Malcolm M. Provus
Director, Time To Teach Project
National Education Association

S: Since I know most of you by your work, I should like to afford you the opportunity to know me on the same basis; and, since little of my work has been published (perhaps for very good reasons), I am going to try to review for you some of my personal research experience in the area of our common interest.

About ten years ago I started teaching American History to high school juniors in a small mid-western town. Early in the game it was apparent that students were disinterested in the omniscient view of the historian. However, students could easily identify with historical personalities who were part of a dramatic problem situation. When given the opportunity to personally commit themselves to problems, some students showed remarkable ingenuity in devising courses of action which appeared more likely to succeed than the actual course of the historical figure with whom they were identifying. The opportunity to dramatize and rewrite history according to their own analysis of history proved to the student to be a satisfying way to learn and suggested to the teacher that student participation in the decisions that helped to cause an historical event was one way of insuring student understanding of the event. For the lack of a better name, I called this approach the transplacement method of teaching history. (See School Review, 1955)

Several kinds of learning materials came to mind in support of this method. Materials were typed according to their function. First, period awareness material, or if you will, the backdrop with which a situation was enveloped was as close to reality as possible. So for instance, a Civil War historical situation would be "propped" with Civil War maps, newspaper clippings, personal letters, excerpts from the Congressional Record, pop art and fiction of the day, and any other materials which might help to establish a feeling for the times.

Against this backdrop another set of more specific materials were used to help structure a particular problem situation. So for instance, if the situation concerned a battle at Gettysburg, the strength of the opposing forces, the number and availability of supporting troups, the disposition of pickets, the mobility of the Confederate cavalry, general morale, conditions of weather, and so forth were made available in a series of factual statements--preferably indexed for quick reference. Finally, a particular historical character with whom the student was asked to identify was carefully sketched in sufficient detail to provide the student with the character's motives and some knowledge of his immediate life space. At this point, a new precipitating factor was introduced into a now somewhat elaborate field, producing an obvious disequilibrium which resulted in the major character being faced with a difficult problem. Given a statement of goals for the major character which was acceptable to the class, the student was now directed to act for this character in such a way that his goal could be achieved.

Under this method, it was essential to arrive at a criteria for measuring the adequacy of student goal attainment. The instructor developed a technique whereby a student would use the class to role-play various critical moments in a problem situation, and thereby establish a pragmatic test of the consequences of the problem solving action he had decided upon for the major character. So for instance, if Lee, learning of the failure of Pickett's charge, were to decide to withdraw rather than press on after the first day of the battle at Gettysburg, several members of the class might play out the reaction of Lee's officers and troops to this decision. Other members of the class might act out the reaction of Confederate politicians while still other students might act out the behavior of key northern decision makers as well as ordinary citizens. The student acting for the major character would therefore create a socio-drama in which the major and minor characters were identified and in which a scenario was provided for the major character but not the minor characters. If the minor characters acted generally as predicted in the student's solution to the problem, the student's solution would be judged to have passed the pragmatic test of consequence.

After using this method for about a year, the instructor was aware of the need for historical realia and materials which provided considerably more detail than was generally available. It was further obvious that extensive teacher work would be required to provide such material. However, the success of the method depended on the quality of student interaction rather than the effectiveness of any materials. With little more than a standard history textbook and the typical resources of a small high school library, it was possible to sustain this method for a second academic year. Of greater consequence for the viability of the method was the instructor's observation that some students were clearly superior to the rest of the class in their ability to provide unprecedented solutions to historical problems. Further, some of these superior problem solvers were not particularly verbal nor of high academic aptitude. All seemed able to closely identify with the feelings and expectations of other human beings. And so, I wrote a doctoral dissertation which attempted to identify some of the affective behavioral characteristics of high school students who were above average in their ability to solve historical problems of the kind used in the transplacement method. After establishing a criterion for problem solving success that could be applied with a relatively high degree of interjudge reliability and after designing a most peculiar test to measure three kinds of affective behavior, it was possible to conclude that successful problem solvers were relatively free from "set" of the kind measured by the Einstellung Effect and were relatively high in their ability to hold a variety of perspectives based upon conflicting value assumptions in a social problem field. The first of these characteristics was called freedom from prejudgment set and the second was called a multiple value perspective.

Although I was now employed at work little related to my interest in creativity, I did give some attention to finding out whether characteristics condusive to social problem solving ability could be developed in a general student population. After all, it seemed disturbingly clear that the behavioral characteristics measured in my dissertation were closely related to personality variables with well documented stability. Such characteristics were not likely to be influenced by classroom instruction.

During 1959 and 1960 while serving as a school principal, I was able to work with school children between the ages of 5 and 15. On the basis of short disconnected classroom periods of from twenty minutes to several hours, I was able to form some opinion about student ability to discover the laws or principles of subject disciplines through exposure to problem situations. Pupil inquiry took place in a group situation subject to the careful control of cues by the instructor. So for instance, it was possible to establish conditions where first graders would discover the concept of multiplication as a form of multiple addition through the use of a diagram of two children, three of their pets, and a series of questions referring to various combinations of parts of all five bodies. (See Instructor Magazine, 1959)

Plato is still the best model for this method which leads one to ask how programed instruction could ever be called socratic in view of its elimination of student-teacher interaction based on an overall plan rather than a specific response pattern. But playing Socrates had its drawbacks. Too often, the desired responses of the student were forced, the discussion was contrived or all-important hypothetical questions failed to ring with a reality sufficient to induce student interest. Further, too often, the method resulted in one or two students discovering a principle, while exposing the rest of the class to the principle by precept.

Apart from these observations on the Socratic method, the instructor concluded that almost all children in a general school population had the ability to inductively solve problems if adequately cued. The intimacy with which the instructor had to know the individual as well as the time required to teach on an individual basis seemed impractical. But the essential student behaviors appeared trainable, given enough practice. Clearly, some students were much further along than others, but they merely seemed to have had more practice. Since it is doubtful that this practice was derived from school experience, the possibility is suggested that child rearing practices in the home produce the twin stability of personality characteristics and creative problem solving ability--both of which appear to be self-perpetuating in the school through their selective effect on new experience. From which it appears to follow that if we are to change a student's problem solving ability, we may have to procede with the same rather painful reconstructuring of human experience as is suggested by the modest successes of the psychotherapist. On such assumptions as these, the resource materials of a Socrates are the pressures of the group, and the esteem of a confident, as well as symbols, concrete models of reality, and phenomena in the real world itself with which to deliniate problems and make dialectic comparisons.

However, when a year later I had an opportunity to spend three months developing materials to teach problem solving techniques, I approached the problem from a mechanistic rather than a theraputic standpoint. The task of constructing such material could be put as follows: 1) Can you orient the student to a clearly defined goal such that this goal has value sufficient to energize the student to work on his own initiative? 2) Can you familiarize the student with all the factors in the field or assume he has prior knowledge of these factors so that the student may meaningfully manipulate these factors? 3) Can some system of information be provided so that the student may probe the nature of field relationships and as a consequence of such trail activity obtain feedback which may have cue value? (Such an information system makes possible self-adjusting activity on the part of the student.) 4) Can the result of pupil interaction with the material produce an awareness or skill of obvious relevance to the established academic school curriculum?

A piece of instructional material was ultimately developed that provided for most of these conditions with the important exception that only limited kinds of feedback information were available. (All The Way Home, Learning Materials, Inc., 1961) To provide the student with all of the major elements in a well defined problem situation, a picture map was presented. A clearly defined goal with which students could meaningfully identify was "the bringing of two small lost children to their home." The feedback system consisted of the student's freedom to compare his choice of manipulations with a limited classification of right-and-wrong consequences.

Ideally, each student manipulation should not have been limited to only two alternatives and a classification merely of response adequacy. Rather the natural consequence of a wide range of possible manipulations should have been provided so that a new manipulation, predicated on this consequence, would be possible, leading to still another natural consequence and so on. However, a series of only eight manipulation opportunities provided with only two alternatives for each manipulation obviously results in a feedback system requiring sixty-four response categories. Where eight manipulations are provided with more than two choices each, the number of response categories is enormously increased. It is obvious that electronic computers are more suited than printed materials to the purpose of providing a naturalistic feedback system for student problem solving efforts. However, the construction of a problem situation, including student goal orientation and the rather imaginative construction of act-consequence field relationships, is not discernably aided by modern technology.

Ultimately, there was some evidence that use of my material resulted in an improved special orientation for the learner--a prerequisite to the map reading skills generally taught in the fourth grade.

In 1961, it was possible to continue my interest in creative problem solving through the auspices of the Chicago Public Schools and the State of Illinois. The first year of what came to be known as the Chicago Creativity Study gave emphasis to the identification of creative problem solvers in a population representative of Chicago Public School children.

We defined creativity as that human activity which produces a self-generated solution to a new and pressing problem. Creative problem solving must consist of behavior which to the learner is new. A solution must not be derived from a teacher or a book or a model; rather, it must be the product of one's own learning processes. In the classroom, creativity is, for the pupil, an unprecedented response to a demanding situation which has never before been faced; an act which, for the individual concerned, is unique. Under this definition, the question arises as to whether such an act must be correct or adequate in order to be called creative. For instance, suppose that a teacher asks his students to find a way to determine the shape of a magnetic force field. Suppose that one student discovers the distribution pattern of iron filings in a magnetic field, while another student discovers that opposite poles attract, and still a third student finds that, given enough magnets, a necklace may be made of them. All three students have made wholly new and unique responses to a new and demanding situation. However, only the first has solved the problem of outlining the dimensions of the magnetic field. The second student has stumbled onto an interesting and important, but largely irrelevant, phenomenon. The third student has produced behavior that might be duplicated by a chimpanzee.

Hence, although much irrelevant new behavior may be creative, we can be only reasonably sure that the first student's behavior is creative because it serves its initial purpose; i.e., it is functional behavior. True, the first student's discovery of a correct solution may be a lucky "one-in-a-million" chance accident. However, it is more likely a result of a mental process which has somehow utilized the student's total capacity to deal with his environment in order to produce a workable solution to the problem posed.

Much of the current creativity research looks for that which is unique rather than that which uniquely provides closure. In the present study, a fantastic scribble of colored lines is creative only when it satisfies pre-existent conditions. A unique arrangement of blocks, words, sentences, or ideas can be distinguished from idiosyncrasy or idiocy only if such an arrangement is meaningful in terms of goal-oriented behavior. To know creative behavior, one must know its object. If its object is known, it may be identified. If its object is unknown, it very likely will be misunderstood. A doodle then is not creative in terms of our definition. Abstract art may be creative if it fits the pre-existent criteria of the artist. But, if the artist is uncertain of his purpose or if the audience has no evidence as to the purpose of the work, then it is not creative in terms of the definition advanced in this paper.

Creative behavior was therefore defined as taking place in a problem solving situation. Problems were so structured that the elements in the field were known to the student and the reorganization of the field leading to the solution was not known. That is, these problems as in the other research I had done required probing activity, insight and field reorganization. The development of an adequate feedback system to permit self-correcting student behavior continued to be a difficult practical problem.

Using some of the test ideas developed by **Guilford and Torrance**, a new test of creative problem solving ability was constructed. Several examples of ideas from this test may be of interest.

1) If I show you Figure 1 and I tell you that there are nine boxes in this first figure, then, assuming I am right, you are to tell me the maximum number of boxes in Figure 2.

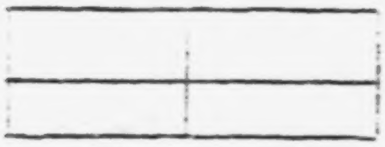


Figure 1

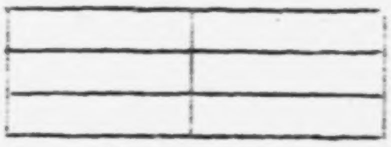


Figure 2

2) Using one sheet of completely blank paper and a single lead pencil, draw three lines exactly parallel to one another and prove that they are parallel.

Using this test, it was possible to determine that a small but significant percentage of students possessed creative problem solving ability in a degree far superior to that of the general population. This superior group was composed mostly of students of superior intelligence. However, the superior group also contained a small but significant number of students of average and below average intelligence. (In a group of 1362 school children, 238 students were identified as superior problem solvers. Of this number, 80 students had IQ's of less than 104.)

It was possible to demonstrate a relationship between student interest in solving certain kinds of open ended questions and performance on the creative problem solving test. Early in the study, it was determined that open ended questions, eventually called "creative learning questions," were valuable as a preliminary instructional materials bridge between student interest and teacher ability to structure problems. Creative learning questions were questions to which neither the teacher nor the student had available an answer on authority. Yet, to which there obviously must be some definitive answers. Examples of such questions were:

- What does fast mean?
- If 1 x 1 = 1, and 1 x 0 = 0, how much is 0 x 0? Can you prove your answer?
- What does it mean to think?
- Can you find anything that you can prove is more than 1,000,000 years old?
- What does it mean to say someone is a "great man"?

As predicted by Torrance, teachers were not favorably disposed toward the use of such questions in their classrooms. Our findings are clear that the over whelming majority of students, regardless of their problem solving ability, enjoyed using such questions in the classroom. However, a small but stable group of students reflected the same dissatisfaction as most teachers with such questions.

C: What age children did you work with?

S: Third through the eighth grade.

C: My hunch is that when you get to college dissatisfaction would be for the majority.

S: The second year of the Chicago Public Schools Creativity Study was primarily aimed at determining whether creative learning materials could be devised so that the antipathy of most classroom teachers could be by-passed and the problem solving activity of students developed irrespective of the inclinations of the teacher toward this end. Seven of our most promising classroom teachers were involved in workshop activity resulting in the production of five or six creative learning lessons presented by means of largely self-explanatory material. These lessons as well as a variety of carefully selected commercial materials were used on a trial basis by some 60 teachers in four different schools. The effectiveness of the materials was rated by three judges. The criteria on which judges rated material was based on the documentation of creative pupil behavior and the observation of teacher-student interactions which were deemed essential to group creative learning experience.

It is disappointing to report that the conclusion we drew from the second year study was that the effectiveness of all creative learning materials used in the experiment was wholly dependent upon the style of the classroom teacher. That is, no amount of sophistication in materials could compensate for the methodological predispositions of the teacher. In those few classrooms where the work of most students could be judged creative, it appeared that the creative learning materials being used were merely an adjunct to a clearly creative teaching method. Of paramount interest, however, was a secondary finding concerning a change in the behavior of the seven teachers who participated in the construction of the creative learning material. The workshop experience of these teachers had apparently made them acutely aware of the importance of their method in fostering creative problem solving ability. Observations of these teachers indicated that substantial changes in their classroom teaching methods had occurred.

The second year study therefore raised the question: Can teachers be sensitized as to the appropriateness of their teaching methods for fostering creativity through workshop experience in the construction of creative learning materials?

A third year of study has been somewhat late in getting underway; but, already its direction is clear. When teachers are involved in intensive workshop experience held at the building level under skilled leadership, the faculty is quickly fragmented into those who flee from the experience (about 1/5 of the faculty), and those who become involved in it to the extent of considerable commitment of time and effort (about 2/5 of the faculty), and those who remain passive (about 2/5 of the faculty).

C: Incidently, I don't think this is bad because you at least get your foot in the door with a small fraction of the staff which leads to other opportunities for staff and student experiences.

S: When you told us this in Chicago a couple of months ago, you really raised our spirits. We were feeling pretty disappointed at that time.

C: But if you expect all teachers to be able to shift gears when you're changing a system, this is too great an expectation to start with. What you really have to hope is that students will have a variety of experience with different teachers. This is learning, I think. And anyway, progress is always made through the efforts of a minority.

S: Yes, this is the strategy we're using now. We use feedback from an advanced group of teachers to encourage the rest.

C: But you may reach a point where there is a back lash.

S: Exactly. That's right.

C: What do you mean?

S: If we promote one group too much the faculty starts to pull itself apart.

C: That won't happen if the staff has a broad picture though: that each teacher is making his own kind of contribution. It takes a good principal to allow for this variation in his staff. A principal can encourage teachers to conduct each others classes so that students get a broad range of experiences.

C: The teachers own security comes first however.

S: Yes, I've seen the extent of the debacle when the teachers security is ignored.

Some schools just split apart and in others you can keep cohesion. There's a full dynamics here that requires investigation.

C: In the statistics that you have, there is no category for those that are hostile.

S: The 1/5 that flee tend to be hostile.

C: Well, let me try and say again what I have said before. In a way if a principal comes in and says now we're going to have a new style of teacher and this is going to be the most important style of teaching, then you put all emphasis there and you get your back lash. But if he says, we're going to allow a variety of styles and they're all important or something of this sort, you may decrease the chance of hostile reaction.

S: Right. Our present strategy is never to talk to teachers about methods.

C: This is a symantic problem, too. The less, perhaps, one says about creativity the better. And the more that's said about problem solving the better because problem solving has a better standing among educators.

S: Next year, our fourth year, of the study, we plan to confront teachers directly with method to see if they have reached a state of self appraisal and willingness to change their teaching behavior.

C: There's a strategy for change. And what you have to do is give the new thing some merit and the old thing some merit. You don't pit them too much against each other. If you do then you get your real hostile.

S: The most promising group, those who react sensitively to the program (a) produce materials of a high degree of sophistication which prove effective in their own classes; (b) indicate, for the most part, the same awareness of the need to change their methods as was observed in the seven teachers participating in the second year study; (c) represent a personnel lever which may be able to free up the efforts of the uncommitted members of the school faculty.

I hope this conference will draw implications from the various research efforts described here which have escaped me; but, in terms of the purpose of this conference, several generalizations would appear in order: 1) Teachers, not materials or media, produce creative learning experiences as defined in this paper.

C: Yes, but we don't really mean an all or none there do we?

S: I'm going to say all in this paper. 2) The social milieu in which creative problem solving occurs is an essential but often overlooked factor in any educational effort to produce meaningful problem solving. (I say this on the assumption that any general population of students can, on the basis of tests now available, be divided into a small group of skilled problem solvers and a large group of those who are relatively unable to sustain meaningful inquiry on their own initiative. The small group will work at most problem tasks irregardless of classroom climate and are, in effect, beyond the need for instruction in problem solving. This group is made up of individuals who will gradually refine their own unique styles of learning through their own self-instructional efforts. The larger group, the group toward which instruction must be directed.is, by definition, made up of individuals who cannot sustain their own efforts. Therefore, a social climate is essential which will balance stress and reward in such a way that the student will feel free to risk failure and loss of self-esteem in an attempt to cope with a problem which is meaningful to the group with whom he has identified.)

C: Before you go on, are you saying here that creative training is really needed for those who are low on creativity rather than those who are high?

S: Yes.

C: You aren't sure that those who are high on these to start with are going to gain much except maybe a little more support.

C: They will gain no matter what you do. So why not spend your time and effort with those who are low on what we assume is a continuum.

C: You would select out the less creative and give them the creative training rather than the more creative if you had to choose?

S: Yes, I would.

C: So realistically you probably would keep them all together. You see, the nature of my question is people say, well, you're going to bring a second kind of gifted and a second kind of program for a second kind of gifted, and so on. The argument you are advancing here is that a program should be designed for those who would not get selected into a gifted program.

S: Of course.

C: You're really arguing for keeping the whole group in.

S: Yes. We have never eliminated anybody from the heterogeneous classroom in these creativity training situations in Chicago.

C: Two thoughts come to my mind. One is, what are the possibilities for using this upper group with the lower group in a kind of an assisting capacity? And the other thing is that our studies have shown, studies of AC Spark Plug and others that I know of have shown, that there have been gains among the low and among the high whenever they have been put into a creative climate or what ever you want to call what these creative problem solving programs and training courses exemplify. I have seen this personally many times in some of the most creative people that have been through our program.

S: How did you measure such growth?

C: Well, mostly by Guilford type tests and so on and gains in creative productivity as at least examplified by these tests.

S: Well, that's doubly impressive because of all the limitations on the tests.

C: The phenomenon of regression statistically would be put in reverse.

S: Yes. That's another reason that it is so impressive.

C: Well, let me go on. You say that programming often overlooks the social media, that perhaps the most important thing in the whole learning situation are the other people. Probably fellow students count for more than the teacher in terms of the climate for learning they can create. And I have a hunch that this may well be so. Fellow students can do this. And so Parne's suggestion, you see, is to use the fellow students as part of the instructional media. Students then feel selected out because of their creative behavior so they are more willing to go around and foster it in others.

C: I think the assumption that problem solving is going to go on in the presence of others problem solvers need not be taken as inevitable. I have seen environments where the most creative people do their best work outside of a social milieu altogether. You see this often in art. Student's can't work in the studio, in class, or in school. I don't think I would take my most talented art student and have him just teach others. You get a lot of other effects on that.

C: Well, maybe it depends on what you are after. Certainly if you are interested in psychotherapudic outcomes, you are correct.

C: But then of course, they are setting up a different type of creative relationship.

C: Well, a good player is not always a good coach, apart from his interpersonal effect on another person.

C: Yes, but this is a very point that I'm getting at. I'm focusing on two people in my thinking as I talk about this who were both personally highly creative people, one in the field of business, one in the field of writing, and in both cases they went through our program. I asked each of them after the program was over what this all meant as far as they were concerned. And both of them almost to the word said something like this. They said, "You know, this has given me two things. One is that I understand for the first time how I've been doing, what I've been doing (you see) and secondly, they said, now I can pass it on to others." In the one case to this man's employees and another case to students because this other person was a teacher. In other words being a creative person in themselves was necessary in order to be able to help others be creative.

C: It had been happening out of consciousness.

C: Right, Exactly.

C: This is what your report said, is there any evidence that these individuals actually did become more effective?

C: No.

C: More creative as business leaders or writers?

C: Well, in the one case of the writer, I would say yes. I mean it was again only my reports of observing the person. In the other case I didn't have continued contact with him.

C: Well, you know, again, in our educational theory, one of the other ways to say it is to what degree do people gain insight into themselves and this is why we are directing our experiences into inner processes and describe it to them so that they can gain this insight and use it as they will later when they are kind of on their own. In terms of your notion this may not be perfect, but I'll bet it is an improvement even if you have got a few poor coaches among them because of the favorable climate it will leave all the way around.

C: Yes. I guess by and large I would say that. I can think of exceptions among what I would consider highly creative and highly interested students.

C: But, overall, I bet this would be quite an improvement.

C: An important element here is "choice" and its effect on different people. Sometimes there are very able, very creative people that seem quite insecure inside who by helping someone seem to be demonstrating to themselves that in this way they can feel more adequate. We've seen this in the reading situation in ways that were most surprising. So I think that when people can choose for themselves whether they will work with others and who they work with, it both enlarges and relieves them.

C: We have an equivalent finding with teachers. In some 350 teachers we gave creativity training in the Bay area, about a third on self-report forms said, "Oh, this is what I have been doing in the classroom. I'm surprised to find it out and to find that it's acceptable enough to now be taught in the class."

C: Now they can do what they have been doing without feeling guilty.

3: 3) If materials are ever to be developed which will afford maximum opportunity for creative problem solving activity, they must utilize highly flexible media with enormous output variability which can do the following: (a) Saturate the student in a quasi-reality such that he is able to touch, see, smell, and practically breathe the field in which his problem is to be solved. (b) Provide a goal that has maximum value to the student in terms of his own unique value system. (c) Provide an environment which can be if not physically manipulated, at least symbolically manipulated with immediate feedback at least comparable in diversity to real life situations. Conceivably, every action need not have an overt reaction, but the problem solver must be able to make inferences which can be tested against the consequence of his manipulations.

4) It may be more feasible to develop new media to support teacher training programs than to develop a diversity of materials for pupil use. If the teacher is the most important variable in any instructional program, perhaps available media and creativity "know how" should be utilized in a few teacher training institutions in order to influence students through their teachers while the science of the art develops. On the basis of our Chicago Public School experience, we believe many teachers can be sensitized to an adequate methodology for teaching creativity. Prospective teachers who are found not to be trainable could be eliminated early in their pre-service preparation, or better yet, could be utilized in continuing research into teacher trainability. Such use of new media in support of pupil creativity would appear to be a most promising and direct way of influencing the future educational opportunities of American children.

C: When you said they could be eliminated immediately, you meant from a creativity training program.

S: The decision could be to eliminate them from any teacher-training program on the grounds that they are not suitable as teachers. But my after thought was to use them as a control group for the evaluation of a training program which stressed creative teaching. One would have to work out a design for this of course.

C: If they are in a training program, where the dimensions of the teaching job are made known to them they may leave the training program of their own volition. There's a great difference in our work where the teachers leave the program because they see the program so incapatible with some of their own values rather than our simply telling teachers they are ineligible to continue.

C: Well, this is an interesting problem. Do you see the master teacher as one that conforms as others, one that uses all the techniques, or as someone who uses his own unique style as a compliment to other teaching roles existent in a school. So you have different styles of teaching in the same system.

C: What I can't understand was your 180 degree shift from the position you had yesterday when we were discussing the place of new media. Yesterdays was cut. Today you are saying it will do everything. How do you reconcile these two?

C: I'm not talking about existing technological media, I'm talking about the hope of what a media system may do some day.

C: Well, if that's the case you say that this media is going to have to create an environment where the person can hear, see, and smell a situation just as it exists. Now what is the role of the teacher in providing this kind of learning experience?

Are you suggesting that teachers will create a situation where students will hear, see, and smell as they learn.

C: Provus seems to be talking quite strongly for what would be called situational training as near to the live situation as possible so there is as little strain on transfer of training.

S: Right. We have to take into account the importance of vicarious experience. Dewey emphasized this often. In a good historical novel you can smell the stench of bodies crowded together in the Roman Forum. Now a learning media capitalizes on the imagination of the learners as well as on simulation technology. Media doesn't exclude the teacher. And it doesn't exclude the other pupils, the way I'm defining it. Or at least the way I hope I will have defined it by the time I leave this conference. Whatever resources are available, both within and outside the learner becomes part of this multi-facited media. It is both plastic and psychodynamic. Somehow it is sensitive to changing states of readiness in each learner.

C: Now I would like to be a little more conservative in the utilization of your teacher-staff. Did you ever think about using these two fifths that were resistant or hostile, to do research, not serve as control for research. If they had the capabilities.

S: Well, now in the Chicago public schools we work under realistic conditions. When you are doing in-service training in the big system, the first thing you must recognize is that you can't make anybody do anything. Second all of our experiences tell us that if you enter the teacher's awareness by his intellectual mode you will generally be rejected. That is you have got to reach the teacher at the level of a felt problem.

C: Well, would you want to offer such teachers a course on methodology of research and then give them some research problems?

S: This is too academic, too formal. Teachers who don't have to take that course for credit probably will reject it. We must reach teachers at the gutts level first, then, after three to six months of this they will be driven to go to the literature and do some research.

C: And then you had better put the book in the school building if you expect it to be read.

S: Yes. You had better excerpt from the book even then and underline parts of it and just spoon feed it to them. That's why they are where they are, that is why you can't get them to do very much. You have got to continue spoon feeding them for awhile until they finally like it enough to reach out and take it for themselves.

C: Is this true of most teachers?

C: Oh yes, I agree it is. But they do change, I think I should say that.

S: It has taken a lot of things to change a teacher's style. We all know that, don't we? The hardest thing in the world is to change a teaching style. When you are a teacher, you are so vulnerable. Their behavior is understandable even though it is not desirable.

C: Well, using our criterion it takes a year and a half before we get a statistical difference in the distribution of teaching acts. And these are people who elected to make the change. And the only difference, the only place where this has not been true has been with four teachers in the College of Nursing with whom I worked this year in Arizona. Two of them changed their teaching patterns in four months. But this is the first time, and I still am not quite sure what was driving them to change except that with the feedback some of their misses were so clear, that we could get a statistical change as they dropped their old teaching acts. We also got a change in distribution, I mean an increase in range of behavior in the classroom. By seeing what they did to students as they listened to their teaching tapes was so dramatic that I think this had an effect. Then when the end of the semester came and they hadn't lost some of their students for the first time in the College of Nursing was something again that dramatized what they thought they had been doing. Except for that one experience, it has taken a year and a half to generally change teacher behavior.

S: One more word about such a teacher training program. I have found that problem situations based on life adjustment incidents are most effective for orienting both student and teachers to their first structured creative problem solving experiences. In one brief research excursion, I used photographs of students and teachers to encourage projection as with a T. A. T. and found a relationship between ease of identification with others and creative problem solving ability. There is a thin line between projection, vicarious experience, empathy and the ability to creatively solve human problems which escapes me.

In a class of student teachers where students role-played anxiety provoking incidents with such realism that tears flowed and fists flew, I felt certain that I could identify creative teachers based on my estimates of their empathy, their tolerance of ambiguity, and their functional use of their own anxiety as inferred from my observations of their role playing behavior--though all of this was unverified. Surely more research is needed to explore relationships between factors which contribute to interpersonal competence and creative teaching and learning. Such research must assume that creative behavior is elemental, functional behavior within the repertoire of most human beings when evoked by circumstance.

Finally, I am going to have my fling at fancy. After all, this is a Creativity Conference and if Torrance's monkeys can have wings, then I too can fly.

What Will The New Media Be Like?

In the classroom of the future, students will stand and fall as members of a learning team. They will participate in elaborate games requiring skill, knowledge, and judgment and will be susceptible to random events and blind luck. Efforts will be rewarded by satisfaction intrinsic to human problem solving activity, the esteem of one's peers, and only incidentally by the acquisition of useful skills and knowledge.

Team members will stand responsible for making decisions effecting sectors of a field subject to their control. They will also participate in group decisions affecting total strategy. Where forces effecting a problem situation are subject to human control, they will be controlled by team members. Where forces are beyond human control, the wheels of fate and cosmic determination will grind on. In any problem situation, there will be no limit to the amount of information available, the number of actions, reactions, and interactions possible.

Whether team members do anything or not, the hands of the universal time clock will turn to the motion of heavenly bodies, the surge of rushing rivers, and gradual decay of brick and mortar, and the life beat of every living thing. Unexpected forces will impinge on everything that is done and undone. The light from an exploding star will tickle the face of a camera lense, an angry woman will cry out, a hawk will rend a field mouse, a soap bubble will burst, a new prime number will be discovered, a butterfly will linger, a baby will laugh, and the horseshoe will fall for wont of which the charge will fail and the battle will be lost.

The learning team will step into a total world. A world perhaps limited in size by an immediately perceived scope, but unlimited in eventuality. The world may be Thoreau's Walden Pond, Caesar's Roman Empire, a spider's web or a kinship structure, but in every case, the life space will be permeable.

The media itself will consist of a series of rooms. The central room is called the problem arena and will contain the topological boundaries of the problem and all of its phenomenological events. One room will provide library information using a retreival system typical of the library facilities of the day. Another room will house extensive laboratory facilities for those natural science and human behavior disciplines which are pertinent to the problem to be solved.

The teacher's role will be very different from that of today. The teacher will not be a party to learning team efforts nor will the teacher guide or council students in any way relative to a problem. The teacher's major task will be to determine team membership for tackling carefully selected problems and to assess individual progress in a confidential manner at the conclusion of a team problem solving experience.

Team discussions, conferences or any exchange of group information or ideas will take place "on site," in the shadow of the problem. There will be no team pre-planning session or post-moritorium critiques. When a problem is finally solved, the team will disband.

Let us join a learning team and enter a problem solving situation through the use of the media that has been described. There are three of us, Arnold, Baker, and Charlie--all are pre-med students. We sit in dark in the problem arena. A light goes on and we see a dog lying on its side in a state of exhaustion. We are told the dog will die unless appropriate remedial action is taken. Then, silence and only the three dimensional picture of the dog remains.

The three of us talk quickly: What are our first priority decisions? Is there a time limit operating? How will we attempt a diagnosis? What facilities are required? What information is required? Who will do what? Arnold will research the diagnosis of dog diseases. Baker will study dog physiology, Charlie will start an immediate examination of the dog to judge prognosis within the limits of his present knowledge and skill.

Charlie first signals for a table under the dog. Then for a close up examination of its eye, mouth, and a determination of its heartbeat by application of a stethescope. Each direction is immediately satisfied by the media. The enlarged eye of the dog rolls beneath the extended eye lid, the tongue is discolored, and the heart thumps with startling irregularity.

Charlie shouts to Arnold through the intercommunication system, "Can this dog be having a heart attack?"

Arnold listens to the heart on his monitor and moves to research the question. First he signals for a normal dog of a similar species--he observes its characteristics and listens to its heartbeat. Next, he signals for the sound of a dog's heart subject to various diseases of the heart: Disease A, Disease B, etc.

"Hmmm! The sound is somewhat similar to the heart of a dog subject to Disease D."

Now, he signals for other symptoms of Disease D.

"No, the dog in the problem does not exhibit these symptoms."

Charlie can be heard shouting again, "The dog is worse! In the fifteen minutes since we began, his condition has deteriorated." Short pause, then "His breathing has stopped!"

Baker interrupts, "Is his heart still beating?"

"Only irregularly," says Charlie.

"How about injecting a stimulant into his blood stream to step up the heart action?"

"Quick! Check heart stimulation in the library."

At this point, a three way conversation is taking place.

"But what if the cause is not in the heart?"

"We must run a risk to keep the dog alive until we can gather more information."

"How about giving him oxygen?"

"Yes, under pressure to control his lung activity."

"Look, we have to do more than get oxygen into his blood. We have to move the oxygen-rich blood through his body; and, that requires heart action."

"Should we massage his heart?"

"If we open his chest we'll kill him for sure."

"How about external massage?"

"O. K, We'll try a massage first as described in Veterinarian's Heart Massage Film-clip #23. If, after three minutes, there is no apparent improvement as measured by his breathing action, we will inject digitalis 'Solution X-3' and place the dog in an oxygen tent. Are we all agreed?"

Charlie leaves Arnold and Baker to administer the treatment. He wants to explore a comment he has noticed in the transcribed summary of Baker's notes on dog physiology: Systematic changes in heartbeat are, in part, controlled by the vagus nerve. Charlie asks and receives answers to a dozen questions in the next few minutes. He learns that certain poisons can change the molecular structure of the nervous system such that serious irregularities in performance occur.

Charlie shouts to Baker and Arnold, "Have you administered the digitalis yet?"

"We're about to."

"Wait! I've got a hunch that the vagus may have been subjected to severe poisons of types A, B, or C."

"But Charlie, the dog is practically dead. We don't have time to research that question."

Arnold grows angry, "You'll kill it for sure with digitalis."

Baker slumps back and moans, "What's the difference, we've lost anyway, haven't we?"

"Damn it, let me get to that dog!" Charlie rushes for the signal panel. The others restrain him.

"Look Charlie," they soothe, "the dog's probably got another five minutes to live. Let's use those five minutes as a team and gain fifteen minutes."

"O. K."

Charlie will research the chemistry of the problem; Baker will look for nerve poison anecdotes; and, Arnold will explore the possibility of tying the dog's circulatory system to an artifical heart machine to keep it alive awhile longer.

And so the drama goes on. Will the team save Fido from the cruel poison? If Arnold tries the overly ambitious expediant of the heart machine, the dog will die. Charlie can unlock the molecular code to the structure of the poisoned vagus nerve and Baker can then come up with a suitable anecdote; but, much more than five minutes' time will be required. The problem can be solved. Perhaps the team members in their desperation will come up with some unique ideas for temporarily sustaining the dog's life while the long-range solution is found. Whether the problem is solved or not, all of the really important kinds of learning will have occurred--systematic analysis, insight, action in the face of uncertainty, personal restraint in the face of emotional disorganization, cooperative effort, paying the price of following a hunch or not following it. Learning will be an exciting, self-directed process of inquiry, utilizing all of man's human and material resources.

Now, I must apologize for being unable to bridge the distance between the meager research reported here and this rather absurd flight of imagination. However, it is always the middle ground between an extant position and a dream which is the real test of problem solving ability and so I leave that problem to the team members of this conference with one final suggestion.

I think the problem is to find ways to use man and machine as components in a training system that responds dynamically to human behavior. In such a system, machines will compensate for the human's limited capacity to physically construct a realistic problem field and humans will compensate for the machine's limited capacity to provide the realistic consequences of manipulation. The resulting half man-half machine system will be the media at the feet of which we will sit and learn to be creative.

C: One thing I'm wondering is what would be the teacher's function in this kind of a learning situation? I always think of the facilitator of learning, the teacher, as being the one who is primarily responsible for a collection of resources. I don't know quite how you fitted that in. You seem to think that media were already existent, already mobilized, but I guess I would think this could well be one of the teacher's major functions; to see that media are available which would be needed as resources. Do you see it some other way?

S: In this exaggerated position for media, that function of the teacher has already been fulfilled. The media is somehow able to be grasped by teachers as educational engineers who know what to use. In the middle ground between this flight of fantasy and where we are at, I'm sure this must be an important function of the teacher. Since that function has been taken over in this example I was more concerned with the therapeutic role of the teacher, who can evaluate things.

C: Alright, I would like to pursue that one further. Are you sure that assessment is of that much value in learning? I guess I have some real questions. Assessment is valuable for outside purposes, or it's even valuable if the learner wants it such as asking did I work this problem in the most effective fashion? I just wondered if that assessment function wasn't something of a carry-over from present procedures.

S: Yes, that's nice because I think it is, and I think the reason it is so important is Guilford's model which was presented yesterday. He showed us how self-evaluation is essential to the learning process. Now he suggests that in-put is required to develop an adequate assessment evaluation facility. But I suspect that a very special kind of in-put is required to develop this self-evaluation process and that is largely interpersonal, almost a therapeutic relationship with another human being.

C: It's probably unfair to criticize such a fascinating fantasy because it's so far removed from the fact, but all I could say is that human nature, seems to me, has got to change radically before this kind of learning situation is going to be successful. I was thinking of the remarks that were made to us yesterday about conditions under which Carl Rogers works in his trying to be and being creative, and I must say that that kind of lonely situation which he described yesterday is the kind of situation that we find reported on by the highly creative individual whom we have seen. It seems to me that you are picturing a situation in which all learning goes on in the group situation. I'm even troubled by our moving to a fourth semester university plan where we are going to keep students learning in a group situation the whole year around with no possibility of getting away, no period for incubation, no summer recess, no going out of the field, to have these changes that go on which are so crucial and so important. It seems to me that when the student is going to come up with behavior that is fresh and original in creative responses, this period is necessary. I don't know whether you mean the fantasy seriously or not, but if you do, to me it's a horrifying picture that you draw for the future.

C: Didn't you have them researching alone and getting ideas?

S: Yes.

C: Yes, but all in written communication so that anybody in the team can ask a question.

C: I'm not sure that this is such a fantasy from some of the things that exist because it's so much like many of the things that we have developed and used in survival training for the Air Force program there.

C: Or even more fearful out of the group situation into a programmed learning situation where everything is programmed into his fantasy around technology; film-clip number 23, and so forth.

C: The thing that concerns me about it is that you have got a certain kind of behavior in mind here and you have developed the system that may cost a half a million dollars to put it together and to support it logistically. You might generate the same kind of behavior with one of your paper back books. The same learning experience may be derived from other simpler sources.

S: Well, certainly not the total experience, not the half a million, but the 10 billion dollar system.

C: On the $10 billion system though is this to generate one class of behavior?

S: That is why it is pretty far from reality. Sure, I haven't the slightest idea that the technology would permit such a system.

C: I'm not sure that with such an elaborate system the technology wouldn't probably treat the dog better than humans can. Just carry it one step further, and let your technology treat the dog. You can say that there is no reason why you can't build in certain machines that will register the heart beat and the bringing together of a lot of other information and dispense the necessary medicine automatically.

S: Now I'm not interested in whether the dog is cured or not. I was only interested in the process rather than the problem.

C: He is designing a more efficient system and we are designing the system for efficiency.

C: Then you are only advocating this kind of learning experience for these kinds of behavior but you recognize that there are other objectives.

S: No. There is only one objective. And that is to teach creative problem solving.

C: You mean for the whole school? There is only one?

S: I mean for the whole person.

C: Do you mean that the societal objectives and so forth then are not necessary to the schools?

S: These are societal objectives.

C: Do you mean that the only kind of behavior that a person has to have to exist in the society is the ability to make certain kinds of decisions? That is it? That is the whole world?

S: The ability to make decisions comprises man's only essential behaviors. I don't want to atomize this behavior.

C: Well, as we hear around the table there would be other people who if they had their fantasy would be sure that they had another kind of activity going on besides yours.

C: It would be an intriguing exercise if each member of this group or as far as that goes any group of people interested in education, did try to do something similar to this and sketch out the kind of things that education might be comprised of 25 years from now and see what they would come up with.

Chapter 6

Implications of Creativity Research Findings for Instructional Media[1]

E. Paul Torrance
Department of Educational Psychology, University of Minnesota

S: Most of the creativity research which I have conducted or directed has been concerned primarily with the kinds of teacher behaviors which encourage creative behavior. Thus, most of the ideas contained in this paper are speculations concerning the kinds of instructional media which will either supplement or substitute for teacher behaviors which seem to be indicated by our research findings. In some cases, however, the ideas presented have already been translated into instructional media by me, some of my graduate advisees, or graduate students in other universities who have modified or tested some of the instructional media developed by us. With one exception, these efforts have been without financial support and as a consequence have been small-scale and rarely sustained and elaborated. One such effort has become practically self-supporting but has required tremendous energy to sustain and has not yielded enough profit to permit research and evaluation.

I find the discussion of implications of creativity research findings for instructional media quite complex. In the construction of a single piece of instructional material I find that we may apply deliberately findings from as many as a dozen different studies and then find that we have violated another or find still others unknowingly applied. If we take a single research finding, we can produce dozens of possible implications for instructional media. Thus,

---

[1] The author is indebted to the New World Foundation, New York City, for a grant which has made it possible to examine, evaluate, and think about applications of creativity research to elementary education, including instructional media.

I shall limit myself to the discussion of some of the more persistent and recurrent research findings which seem to have some of the more far-reaching implications.

Implications of Discontinuities in Creative Development

One of the most persistent and recurrent findings in creativity research with children is that there are discontinuities in creative development, apparently accompanied by loss of interest in learning, increase in behavioral problems, and increase in emotional disturbance. These discontinuities have been noted by a variety of investigators for many years (Andrews, 1930; Colvin and Meyer, 1906; Kirkpatrick, 1900; Mearns, 1931; Simpson, 1922, Whipple, 1915; and Wilt, 1959). At least in Anglo-American cultures these discontinuities seem to appear at about the kindergarten, fourth grade and seventh grade levels. Children at these stages of development perform less well than they did a year earlier and less well than children at the next lower educational level on tests of imagination, originality, creativity, and divergent thinking regardless of the label used. They also participate in fewer creative activities on their own, appear to lose some of their curiosity, manipulativeness, and excitement about learning. There are also some indications that these are peak periods of psychiatric referral, remedial instruction and behavior problems. They are certainly peak periods of concern for the parents who write me letters concerning the struggles of their creative children.

C: As I recall most of your original evidence was on a series of cross-sectional studies, have you done any longitudinal studies to show this is true per individual? Double-checked this that way?

S: Well, we are now going in to the sixth year of our longitudinal studies. We're just getting the data converted to standard scores, using the same scoring schemes and that sort of thing and we find that there are various kinds of patterns. Of course these were conducted in an atmosphere where a lot of educational change has been going on. Just this year, there have been a larger number of studies appearing in which, for example the slump that we found in the fourth grade, which is one of the most severe, and seems to have some of the most important ramifications, that this does not occur. But even now, there are many instances in which it still occurs in spite of all the talking that we have been doing about it. We, of course, can only guess about what is happening in these cases. Certainly in the cases I know about where they have not found any slump at the fourth grade, there has been an interest in doing something about it such as we had already demonstrated.

In the past, little significance has been attached to these discontinuities in development. Observers have concluded that these were natural, genetically determined phenomena about which nothing could be nor need be done. Others have discounted the significance of these findings by pointing out that we have plateaus in almost all kinds of development. It has seemed to me, however, that these drops in creative functioning are more serious than learning plateaus and are man-made or culture-made. As we have begun to concentrate upon the discontinuity which occurs at about the beginning of the fourth grade, we find that the pupils in one fourth-grade class in a school may continue to show growth while those in another class of the same school show a decrement. Or, all of the fourth grade classes in one school may show growth while those in another school may all show decrements. No discontinuities occur in such continuous cultures as Western Samoa, Sikhs in India, and the like (Johnson, 1963; Torrance, 1963a).

What most people have failed to recognize is the evidence that development can be quite different when children experience guided, planned experiences than when they experience only what the environment just happens to provide (Ojemann, 1948; Ojemann and Pritchett, 1963). My associates and I have demonstrated (Torrance and Gupta, 1964) that the concept of guided, planned experiences in creative thinking can be translated into instructional materials in the form of audio-tapes, teacher's manuals, and exercises which eliminate for most fourth-grade children the fourth-grade slump in creativity and result in fewer children hating school and greater participation in self-initiated activities of a creative nature. As in other concepts of guided, planned experiences, the development of materials is guided by an analysis of the structure of the learning task, the nature and status of the learner, and the motivation of the learner to participate in the sequence of activities designed to facilitate a particular kind of development.

In my opinion, we find the clue to constructing materials to eliminate discontinuities in creative development in the theory behind the Mental Orthopedics designed by Alfred Binet and discussed in his 1909 publication (Les Idées Modernes sur les Enfants). Binet maintained that all, or almost all, children begin school with highly developed skills in learning by experimenting, manipulating objects, rearranging them and combining them in different ways, singing, drawing, dancing, story-telling and the like. It was his contention that we should graft education on these already highly developed learning skills rather than suddenly abandoning learning in these ways for learning in ways strange to the child.

In designing instructional materials to reduce discontinuities in creative development, it seems reasonable that there should be a reduction in the discontinuities in vocabulary, style of presentation, and the nature of the intellectual skills called into play. Efforts should be made to make positive, creative use of the early learned ways of learning. Viewed in this way, it would not be necessary to invoke such psychological concepts as primary processes, regression, primitivation, and the like. It would not be necessary for Synectics groups (Gordon, 1961) to work so hard to create the psychological state of play. At least for education, it might be more productive to abandon these concepts and cast the phenomena in more positive, pushing forward rather than regressing behavior -- that is, of building onto the learning skills that are developed almost from birth.

C: I would like to ask about this liking and disliking of school, was this a study at the fourth grade level.

S: Yes.

C: Has anyone done any study across and found where the dips occur in your curves? This is also where the dislikes increase?

S: No. I don't know of any of that kind. We have checked with a number of psychoeducational clinics and mental hygiene clinics and we find there that these are peak periods for them depending somewhat on the reputation of the agency. In one large city-wide survey in Los Angeles, it was found that the peak in referrals to mental hygiene clinics and psychiatriac referrals and that sort of thing, occurred in the fourth and fifth grades. This is the kind of investigation that should be done and I can think of a dozen others in that area, too. We need to do some real fact finding whereas to the present, we only have observational data and anecdotal data.

C: Do you have any data on the drop out problem among those students?

S: No.

C: You're indicating that these are certain seeds for dropouts.

S: One of the interesting things that we discovered in the fourth-grade study seems to be relevant to the drop out problem. At the time of the post-test, over thirty *fewer* children were present than were present at the time of the pre-test. The reverse was true in the experimental classes -- over thirty *more* were present for the post-test than for the pre-test. These results are at least suggestive. I wish we had obtained attendance data, tardiness data, records of illnesses and the like.

Changing Ways of Storing Information

Although both Ray Hyman (1961, 1963) and I and my associates (Torrance and Harmon, 1961; Torrance and Staff, 1964) have by no means answered all of the questions about the storage of information and the availability of information for use in the creative solution of problems, it does seem quite clear that the attitude one assumes toward the information he possesses makes a great deal of difference about the way it will be used. I have found it quite easy to create different attitudes, sets, or expectations about information among my own students. These attitudes in turn make a great deal of difference in what students do with the information they encounter. For example, I may ask some students to read research articles during the first half of a course with a critical set, identifying defects in the researcher's assumptions, statement of his problem, hypotheses, instruments of data collection, experimental procedures, analysis of data, and interpretation of findings. Other students are asked to read research articles with a constructive, creative set, trying to think of other possibilities, applications, and the like. The latter group of students during the second half of the course are themselves able to develop more original and useful ideas and to produce a larger number of creative applications of specific information than are their critical peers. Similar kinds of results were obtained when sets were established for reading traditional textbook material.

Since books provide perhaps the best invention yet for becoming educated, it might be that we should put a large share of our creative energy into inventing ways of making books more effective for evoking creative behavior. I am convinced that we can build into textbooks at all levels of education much of what we have learned from research about the creative process, the creative thinking abilities, the creative personality, and conditions favorable to creative growth. I tried deliberately to do this in one textbook in my own teaching field, personality and mental health. I employed many techniques to involve the reader and his experiences. The language I chose was self-involving. I tried to heighten anticipation, gave the reader opportunities to reorganize and rearrange information for various purposes, and the like. Instead of the usual dull, repetitious summaries, I gave the reader opportunities to synthesize the knowledge contained in a chapter for the purpose of solving problems. I encouraged scanning and other devices for getting ideas. Since the publisher would not release me from my contract, I was forced to abandon all of these devices. The manuscript is now in the final stages of editing and contains none of the self-involving language and none of the devices to encourage the reader to reorganize information. All of the liveliness and originality of expression are being edited out. Everything to heighten expectations, to encourage thinking in terms of possibles, and to facilitate creative application of knowledge has been eliminated. Each chapter now has a very proper summary. Except for content it has become a conforming, traditional text. Everything that we award points for originality and interest in children's compositions has been edited out.

Perhaps one type of support that the U. S. Office of Education should consider is the preparation, editing, and testing of sample textbooks having the same subject-matter content insofar as facts and data are concerned. They would differ in format. One variation would be the type which publishers and editors now insist upon. The other would be the type that applies deliberately creativity research findings. In the experimental texts deliberate attempts would be made to build into them the best we know about the creative process, the creative person, and the like. Skills in creative problem-solving of various kindswould be encouraged. A different set of criteria would be employed by editors in reshaping the author's ideas than is in current use.

I realize that this would be a relatively expensive type of experiment and one not likely to be supported by publishers. Thus, I believe that it is a kind of effort which must be supported by the U. S. Office of Education, foundations, and the like. I also believe that such experiments are likely to lead to success. Already we have some excellent examples in the form of courses which have been carefully redesigned in much the same way that I have advocated for the redesigning of textbooks. One of the more carefully and elaborately worked out experiments was Sommers' college level experiment in industrial design. He carefully kept the subject-matter content of the two courses constant in the control and experimental classes through two replications of the original experiment. Not only did he find greater growth in general creative thinking ability when the materials were presented according to the creative thinking design, but he also found significantly higher achievement on his traditional test of understanding of principles, application of principles, and the like, as measured by multiple-choice tests. Apparently, having produced, tested, and experimented with a diversity of approaches, the experimental subjects gained greater mastery of the fundamental ideas taught in the course.

C: Before you go on I want to get a point in. Marie Hughes, I recall your articles which the editors said didn't have enough expected materials in them and so they paid you for them and never published them. This meant that they had too much new materials in them. I also recall a session I had with a publishing house in which they openly admitted that they have a problem such as this. They couldn't get the right message in the right place, that when they select an editor for a series, they sometimes make a bad boner or they're lucky if they get a person who is looking forward and can select materials that are the forerunners of tomorrow, as distinct from one who selects from a pattern in the past which has succeeded and is just reproducing the past. They talked off the record this way to me, but to them this is a great concern when they selected editors, who run the old pattern and that pattern has already run its days. So there are a few places where there are hopes that there may be awareness of this type of thing.

C: I think the Speaker's implication is that one really couldn't expect commercial organization to drum the kind of risk that's involved where the government might, is very meaningful here. It's probably more than just the editors. There is a considerable risk of money involved.

C: You know there is a risk where you don't do something new, too. I mean, you're risking ruin when you hang on to the old, too long, too hard, and this is what this is. A president of a publishing company was telling me about this as one of their saddest stories. How do they get rid of an editor whom they selected ten or twenty years ago and he has missed all the good bets that have come along since?

S: I won the major battle on content. This was, of course, in mental health. And it seemed to me that one of the things that you ought to have in a mental health course is what we know about the psychology of stress. And you find thishardly mentioned at all in any of the existing educational psychology books on mental health. There is only one that I know about that even has a chapter on stress and it was written for psychology rather than educational psychology. It seemed to me that another thing mental health texts ought to be concerned about is the human mind and its functioning and you find practically nothing about this in existing textbooks. When the reviewers said that it didn't have enough of the expected or traditional content, I replied that this was surely true. I had indicated at the outset that it would be true. I explained that it seemed to me that a research-oriented person has a responsibility to break away from the traditional content and fashion the field as the newer knowledge in the field indicates that it should be. The battle over content was won after much argument. The battle over format and style of presentation was lost in another way. In order to make the book more self-involving, I had used the first person. (I probably owe a debt to Ross Mooney for giving me the courage to use the first person in research writing.) By asking teachers over the country if they would select a text written in the first person, the publisher hushed me on this score. I am not sure that teachers will reject a text on this basis. For instance, Prentice-Hall has published two of my books written in the first person and both of them have a strong research orientation. Neither the reviewers nor the editors have objected to the use of the first person. Thus, I believe that there are some publishers willing to tolerate innovations.

Materials that Permit One Thing to Lead to Another

Almost by definiton, the creative process requires that one thing be permitted to lead to another. On many occasions as I have conducted experiments, tested children, and observed classroom activities during the past seven years, it has struck me that it is quite unnatural for children to be herded from one unrelated activity to another every 15 or 20 minutes with no opportunity to become absorbed in anything, with no continuity. I can recall a class of fifth grade pupils being rebuffed continually by the teacher because they kept asking about things studied earlier in the day and because they kept pointing out relationships between what they were studying at the time and what they had studied in another course the day before. This occurred near the beginning of the term. No such observations were recorded near the end of the school year. On the other hand, I can recall the excitement of one third grade class in a creative dramatics project involving original serials created by class members. I have observed these continued dramatics during an hour when the teacher was out of the classroom. These productions were well organized and there was absorbed watching and listening on the part of all members of the class.

Our own attempts to create guided, planned experiences in creative thinking through audio-tapes, thinking activities, teacher guides, and the like for the fourth grade present one attempt to provide such sequences of experiences. One series is called "Great Moments of Scientific Discovery." Another is concerned with "Great Moments of Geographic Discovery"; another, "Great Moments in History." Still another involves fantasies. The heart of the audio-tapes in the first three series is dramatized episodes in the lives of creative persons. These are designed to grip the interests of children and to familiarize them with the nature and value of the creative process, the creative person, and creative achievement. These may be stopped at strategic points for problem-solving, guessing of consequences, and consideration of various possibilities. Usually, however, this occurs after the playing of the dramatized episodes. This is followed by discussions, inquiries and either individual or group activities of a creative nature. The teacher guides offer many alternatives and challenge teachers to produce their own ideas to achieve goals stated in the manuals or the specific goals of the class. On a subsequent day, a related experience is presented by means of the audio-tape. This experience may involve an experiment, creative writing, art, dramatics, song writing, creative problem-solving, inventing, or any of a number of other creative activities.

For example, the dramatized episodes of the life of Louis Braille emphasiz the idea that a child's ideas may be valuable and that great discoveries and inventions occur through persistence, building onto the ideas and failures of others, and courage. One of the lessons accompanying this story leads children to make an inventory of the things that bother them and to select their most bothersome "thorn in the flesh." They are asked then to define the characteristics of the device, procedure, or the like that would solve this bothersome problem. They are then asked to find out what other attempts have been made to solve this problem and to build onto it.

C: Has anyone picked up and built some more materials like these or have you generated them so now you will build some more of these?

S: Yes. There have been some but to do it well is a fairly expensive thing. We have several individuals with very exciting ideas of elaborating it into other fields, and other age groups, and that sort of thing, being presented to publishers and others and I don't know of any actual buyers yet. Ginn and Co. will publish these materials that we have developed and they have put some investment in a further year of development of these materials.

C: As I understand these dramatic episodes were translated onto tape using professional talent.

S: Yes. We used kind of semi-professional talent. They were the best acting talent that we had on the campus of the University of Minnesota. And we were also able to draw from the interns in the Guthrie Theater. So we had very good acting talent. We are quite proud of the acting performance that we got out of most of them. That is basically the design. The basic design for most of them, for example, in the "Great Moments of Discovery", is to present episodes from the lives of a highly creative person like Robert Goddard, Franklin, or the others, using these to communicate something about the nature of the creative process, the idea that their ideas may be important now, and then using these as a take-off for a variety of kinds of activity. And in the manual we do have suggestions for a variety of them and since the manuals have been created many other kinds of exercises have been created. And then a second part of each unit is one or more recorded possible exercises which they could use in which we tried to engage the children in thinking activities that are somewhat similar to those engaged in by the inventor. Well, even in the case of Giovanni and the Giant, which is a fantasy, we use in the actual dramatization itself a stop-tape device where we stop the tape every time Giovanni gets in a predicament and ask the children to think of possible solutions. By the time they've gotten through they have enough material to create a new version of Giovanni and the Giant. One of the recent kind of things that we have created out of this is taking the fact that

Giovanni used deception to accomplish his task with the giant and using it to gain consideration of the deceptions that are practiced on us human beings every day. One version involves three every-day kind of episodes of swindles and deceptions and getting children to think about what are the clues that you get that there is deception. What are the things that you ought to ask about and that sort of thing. The same kind of thing can be done with some of the world famous, historically famous hoaxes and deceptions which can be easily tied into a curriculum in history or geography if you want to make that kind of tie-in. It's entirely up to the teacher using it as to whether or not they want to tie it in with geography and you can find these in almost any period of history and with any geographical area you want.

C: Other questions that come to my mind is that aren't there hundreds or you might say thousands of people in this nation in educational programs, colleges of education, school districts, military and so on who are audio visual people who are spending full time in passing out, using and maybe even producing audio-visual material? Are we reaching them at all, are they getting in this act at all or are they still running independently of us? Isn't there quite a human effort nationally every year in producing audio-visual material, producing some of the stuff like this that they haven't had in the past?

C: There is evidence of this increasing all the time.

C: But isn't there a large number of people putting a lot of human effort into producing material?

C: Yes. The National Association of Educational Broadcasters is an organization that presumable creates tapes on various subjects.

C: Isn't there an audio-visual person in every college of education and in almost every school district?

C: But that person generally is not a person who produces very much. He's more of a custodian.

C: He's just a custodian.

C: Very few of them have seen this other aspect as part of their job. They haven't been producers.

C: As a matter of fact they're often not selected to be producers although I agree with you that they should be. The fact that they are working with the faculty as you well know is a difficult chore and the original idea is supposed to come from the faculty not from the clerk or from the service. So that an AV person is a person who is in a very awkward position in most institutions of higher learning, unless he happens to have control or functions with the local television station or unless someone happens to have a research project and they need materials developed for that.

C: Well, in almost every area of the university Film Producers Association and the other ones you mentioned there are research grants in the science areas and there is an awful lot of material being produced. Whether it would fit into the context that you're talking about I think is another matter.

C: Are there any of them tuned in to what we're talking about?

C: I don't know what kind of evidence that you'd want to validate this. Do you think that the materials that are being reported in any place are tuned into this? Do you think that your own audio-visual center is producing materials that are tuned into this?

C: Well, you see, I always think of faculty members or staff people as people who can do two jobs, that is, run an old system and also produce something of their own. A lot of people don't do this right. There is a lot of human effort around potentially available, some of it is available, some of it could catch onto this as a new way to spread its work.

C: I think there is greater capability every year almost all over the country to do this sort of thing as far as the technology is concerned. There are more cameras being acquired, there are more film editors, there are more artists being hired, there's growing capability for this.

C: But, we haven't reached them in terms of the kinds of materials, say that our speaker here is grinding out of his shop. They haven't gotten a hold of this and going with it.

C: You have the technical resources for it and you have the technical personnel to help you but very often these technical personnel don't hav the leaders who are supposed to give them assistance in terms of what to record or what to shoot or what to edit or for what purpose or to open doors for them so that they can enter new areas and work with those areas.

C: I can remember one shot of a biology professor milking a snake and the venom was running down the side of a glass and he said, "Watch carefully students. This may be our last class." I thought that was a rather creative piece of material.

C: I'd like to see come out of this conference one specific type of thing. I would like to get Paul Torrance's works actually on a wide scale basis.

C: Well, in this culture it would have to be a private enterprise that would buy it.

C: What could be more significant to educational TV than all these, there must be ways that these could be brought into wider attention.

C: There are tape depositories to distribute video tapes and kinescopes. There are three of them in the country that have been sponsored by the U. S. Office but they are mostly listing materials, to tell you where it's available, how you can get these materials, if they happen to be in the area that you're interested in.

C: Well, my message was not entirely that. I think the greatest contribution industrial psychologists can make to a large organization is to educate all people that every member has a mind and that this tremendous resourse is largely unused. Saying the same thing, there are a lot of people in audio-visual work and a lot of budget already that's invested in these people and in their minds. But if you can get this message to them to produce stuff that they need or their colleagues need this seems to be an illustration of what can be done, and then this is where the great resources are. It's already paid for. There's plenty of money around. There are plenty of chances for them to do something with their limited facilities. And when they start doing something, they'll get more facilities.

C: Well, when I worked on TV one of the things that interested me is that there is no difficulty in selling the idea in the sense that educational TV wants it. This I can do any day, at least to date, I've been able to do it. But it's always put into a regular program which has a format and you have to rework yourmaterial for that format instead of doing the creative thing you started out to do. I had to do this again in Arizona last fall when I was asked to do some work. I thought up something that was very good. But once again it had to go into a slot and in going in all the things I felt were good were chopped off.

C: I'd like to ask two questions. One is a hitch-hike on Parne's idea. I think both are directed towards the objective of the conference, but do you suppose, Dr. Torrance, it would be possible to design a paradigm or a model of the divergent thinking process which you could give new media technologists to design the type of thing you're doing? Maybe they don't know about the Guilford model and the divergent thinking processes.

S: I might just say that I taught a course at Colorado State College which has a good reputation for a summer school, we had forty people there on an elective basis in a curriculum course and I asked how many had heard of the Getzels-Jackson studies. Two hands went up. Thirty-eight didn't. And this might be one of the outcomes of this conference.

C: Did you design your media from say a divergent thinking paradigm? Have you ever created such a model?

S: Yes. We deliberately tried to put into the teacher's guides and into the recordings themselves, the best we know, or we think we know, about the nature of the process, the creative personality, drawing from the lives of eminent creative people, creative thinking abilities and laboratory experiments. For example, we have some exercises based on Maltzman's work, just one example of how you use warm-up and that kind of thing. So, in the various recordings I suppose that they would add up to something that could be called a model.

Realistic problems may be related even to fantasies. For example, the dramatization based on the old Italian legend of Giovanni and the Giant gives rise to a variety of such opportunities. In the drama itself (Cunnington, Buckland and Peterson, 1962) the stop-tape device is employed. Each time Giovanni finds himself in a threatening predicament, the tape is stopped to permit the listeners to produce possible solutions to the predicament.

By the time the story is finished, each student has produced enough ideas for a new version of the Giovanni and Giant story. On the following day, however, the story may be used to encourage a very different kind of thinking. In the original story Giovanni used deception. In the related exercise, students are asked to develop some of the skills of penetrating deceptions. In one version, common, everyday swindles and hoaxes may be dramatized and the listeners asked to penetrate the deception. In another version, some of the historically famous hoaxes may be similarly dramatized and used. These may be related to the geography or history being studied at the particular time.

All of these materials make a great deal of deliberate use of the principle of warm-up and draw from such research as that of Maltzman (1960) on training for originality. One of the best examples of this is our "Sounds and Images" (Torrance and Cunnington, 1962) which makes use of a series of four sound effects presented three times. With each repetition, students are asked to stretch their imaginations further and further. The first sound effect is easily recognized, coherent, and well-organized. Succeeding sound effects increase in strangeness and lack of obvious relationships among the sound elements. The fourth sound effect involves six rather strange and unrelated sound elements, placing quite a burden upon the ability to synthesize into a coherent whole unrelated elements.

The idea books created by Myers represent another kind of attempt to create materials which engage children in a sequence of creative thinking activities, leading to increasingly higher stages of thinking. There are now two sets, including teacher guides, for the primary grades. (Can You Imagine? and For Those Who Wonder), one for the intermediate grades (Invitations to Thinking and Doing) and one for the upper elementary and junior high school years (Invitations to Speaking and Writing Creatively). All of these have been field-tested with encouraging results, some of them quite carefully done and others conducted rather subjectively.

In a number of children's books this same principle is applied with considerable skill. An example of considerable artistry in this respect is the work of the Italian artist and story teller, Bruno Munari, as in The Elephant's Wish (1959), Who's There? Open the Door (1957), and The Birthday Present (1959).

Materials That Inform about the Creative Process

Critics have questioned the value of education concerning the creative process. Some even feel that having information concerning the creative process may interfere with creative functioning. This, of course, has been one of the major goals of the audio-tapes concerning the lives of creative people such as Robert Goddard, Thomas Edison, Benjamin Franklin, and others. We do know that children obtain ideas from accounts of the creative processes of these men. We also know that they can engage in activities which require some of the same kinds of thinking processes that the creativeperson used in his great achievements. At a rather practical level, however, I believe we have at least one rather good experiment which indicates that just the giving of information about the creative process, overcoming blocks to creativity, and the like may result in significant creative growth not ordinarly achieved (D. N. Anderson, 1963). In a general education course in industrial arts, Don Anderson employed three conditions. In addition to the usual control condition, he gave brief creative thinking exercises in one condition and in the other he merely handed out from time to time sheets giving information about the creative process, becoming more creative, and the like. No classroom time was devoted to a discussion of these sheets. Any discussion was among students and on their own time outside class. Students in this latter condition showed significantly greater growth in measured creative thinking abilities than their peers who had not been given these handouts or "propaganda" about creativity.

Materials for Teaching Research Concepts and Skills

Although our educational system has been delaying research experiences and requirements longer and longer, many promising developments such as those of Jablonski at the University of Pittsburgh indicate that there is a great readiness among high school and elementary school students for research. In the light of the lives of those who have become eminent as creative achievers this is not surprising; many of them began early to develop research concepts and skills. It has been my contention that children can be taught these powerful concepts early in their educational careers and that these concepts then become tools in their thinking and learning throughout their lives. They then become "overlearned" along with other skills and concepts taught at this time, whereas desirable habits and attitudes of research may never be mastered if postponed too long.

My own experiences in teaching high achieving sixth-grade pupils some of these research concepts and skills has been tremendously rewarding. We find many evidences that the children exposed to the five-day course continue to use the concepts and skills developed in their other course and activites in subsequent years. I try to give them a taste of a variety of kinds of research (historical descriptive-comparative, and experimental). They are also permitted to conduct an experiment themselves and required to write it up in standard form. Myers and I (Torrance and Myers, 1962ab) have combined the materials we developed for this purpose into a monograph which has been used by a variety of teachers who report rather exciting results. I believe that such concepts and skills can be developed through practically all courses in the curriculum and that textbooks, workbooks, and other materials in various subjects can be redesigned in such a way as to develop research concepts and skills.

Honesty and Realism in Presenting Lives of Creative People

A number of people have criticized the audio-tapes in the Great Moments of Discovery series because they present such persons as Robert Goddard, Henry Ford, Samuel F. B. Morse, and the like as something less than models of social adjustment and well-rounded personalities. I have been told that we should present these great men as "more normal" or "better adjusted." Believing that anything that militates against honesty and the search for the truth is inimical to creative development, I have stood by our decision to present these personalities as honestly as possible. One of the arguments has been that this honest presentation of scientists will dissuade youngsters from careers in science and creative occupations. Our experiences with the fourth-grade materials are in contradiction to this point of view. One of the effects of the experimental materials was that there was an increase in aspirations in scientific fields, especially among the girls. There was also a tendency for an increase in aspirations in the arts, although the tapes did not deal with the arts. There were significant increases in career aspirations in uncommon and in creative occupations.

Knowledge Presented as Incomplete

Also related to honesty of presentation is the idea of presenting knowledge as incomplete, with gaps, and unknowns. Current textbooks tend to present knowledge as being complete and absolute. This is communicated both by content and in subtle ways by the language used. I am now having a very painful experience with an editor who is superb at making my language absolute and certain and eliminating any references to unknowns, uncertainties, and gaps in knowledge. If textbooks could assume this stance, I believe it would free teachers to be more honest in this regard and to be less threatened when students ask questions about the unknowns in a particular field of study.

Closely related to this problem is that of asking provocative questions about unknowns. There is considerable evidence to indicate that most questions asked by teachers call only for the reproduction of information in textbooks. The questions asked in the textbooks are rarely much better. It is my suspicion that if textbooks contained provocative questions, this would help teachers learn how to ask such questions of their own and thereby engage much more of the creative potential of their students than is now the case. Present evidence is that even our more creative teachers ask relatively few provocative questions. Using Burkhart's criteria (Burkhart and Bernheim, 1963), I scored the questions asked by the six most and least creative teachers (as identified by a battery of creative thinking tests) in a population of 32 general business teachers. The six most creative teachers asked significantly more provocative or divergent questions than their less creative colleagues. Only about 12 per cent of their questions were of this type, however. It was less than one per cent among the six least creative teachers, however.

Materials to Encourage Creative Characteristics

If we are to cultivate and sustain genuinely creative behavior, it seems logical that our society must in a variety of ways encourage those personality characteristics which seem essential for such behavior. We have derived many clues about the nature of the creative person from the studies of MacKinnon (1961, 1962), Barron (1963), and dozens of others (Stein and Heinze, 1960). It seems to me we should be especially mindful about those characteristics which are necessary for genuinely creative behavior but which are not especially honored by our society. In order to obtain clues concerning what these characteristics are we have asked teachers and parents in our own various subcultures and in cultures outside the United States to describe the ideal pupil or the kind of person they would like for today's children to become. We have also asked serious students of the creative personality as revealed through research findings to use the same checklist to describe what might be considered a model of the productive, creative person. This enables us to identify the discrepant characteristics.

From our data it can be inferred that all of the cultures thus far studied, according to the rankings of our expert panel, are unduly punishing of the good guesser, the child who has intellectual courage, the emotionally sensitive individual, the intuitive thinker, the person who regresses occasionally and is playful and childlike, the visionary individual and the person who is unwilling to accept things on mere say so without examining the evidence. On the other hand, they seem to lavish unduly great rewards for being courteous, doing one's work on time, being obedient and popular or well-liked by one's peers, and being willing to accept the judgments of authorities. Teachers in the United States also appear to be unduly discouraging of strong emotional feelings and unduly encouraging of receptiveness to the ideas of others. Independence in thinking is highly honored but independence in judgment is rated much lower by teachers and parents.

Since the characteristics of creative people appear in the lives of the subjects of the dramas in our Great Moments of Discovery series, these are a natural for honoring such characteristics as intellectual courage, willingness to guess and test one's guesses, emotional sensitivity, intuition, vision, and the like. Ardyth Hebeisen, a former student of mine, has been creating stories for young children that emphasize some of these characteristics. Such an effort, however, can be extended in many directions. For example, I have had some interesting exchanges with Garry C. Myers, the editor of Highlights for Children, about what might be done through his feature known as "Gallant and Goofus." I have suggested that although it is fine for Gallant to be courteous and polite, he might also picture Gallant as being honest and courageous. He recognizes this need but is somewhat fearful that this will cause children to get into trouble and that he will be blamed. In recent issues, he has been experimenting with a few ideas. Thus, we find in a recent issue (Myers, 1964) that Gallant does not cry when he loses a game, stands up and defends himself, and admits that he broke his mother's vase, apologizing of course.

Correcting Misplaced Emphases on Sex Differences

Our studies of sex differences in independent activities, measured thinking abilities, and the like, indicate rather clearly that our society places off limits or makes taboo for each sex whole areas of experiencing because of their sex (Torrance, 1964). This seems to take an unduly great toll upon the awareness and potential functioning of both boys and girls. Thus, it seems to me that one way of encouraging the development of creative potential is to provide materials which will help to correct some of this misplaced emphasis on sex differences. Even our vocational guidance materials in the earlier years could be more realistic. For example, we could have true stories of male nurses (and I understand there are some outstanding ones who find nursing congenial to the role and life of a man) and female dentists (and I understand there are some excellent ones who find this occupation quite congenial to the role and way of life of a woman).

Encouraging Elaboration as Well as Originality

There may be some danger that some of our current efforts emphasize originality of ideas to the relative neglect of elaboration. My own study of creativity, whether through the lives of eminent creative people or through the experiences of children and young people, convinces me that we need both the good elaborators and the highly original thinkers. In the dramas of the Great Moments of Discovery series, this characteristic comes out quite naturally and can be elaborated in many different ways. This ability also seems important in everyday adjustment. For example, one study of the thinking abilities of delinquent girls (Will, 1964) reveals their outstanding thinking characteristic to be their serious inability to elaborate. Furthermore, reading specialists (Burrell and Chambers, 1958) have concluded from their research that exercises in elaboration are extremely promising in the development of good readers.

Different Materials for Different Kinds of Learners

A great variety of research (McConnell, 1934; Hutchinson, 1961; Gotkin and Massa, 1963; Grover, 1963) indicates that when we change teaching methods, a new class or classes of star learners emerge. If creative thinking abilities are called upon in the learning process, children with superior creative thinking abilities and motivations emerge as the stars. If these abilities are not used, these same individuals frequently fail to achieve. We have talked for many years about the need for individualization of instruction. It has occurred to me, however, that it might be easier and more practical to individualize instruction for different types of learners through differentiated curriculum materials than in traditional ways. This becomes especially urgent when we consider the increasing prevalence of large classes. Instructional materials might also be developed, however, to encourage greater curiosity and skills of creative thinking among children who have lagged in this kind of development.

Textbook Flexibility and Supplementary Materials

In searching for ways of making textbooks as flexible as possible and at the same time developing some of the skills of creative thinking and behavior, separate laboratory manuals, idea books, or work books might be developed. One section might be provided as an "idea trap" for the listing and development of provocative ideas, provocative questions, and the like. The remainder could be geared specifically to specific content chapter by chapter. The exercises which require the reorganization and rearrangement of material, the development of syntheses of materials in order to solve problems, scanning for cues for problem solution, and the like could be included.

We can derive support for this and the idea for differentiating instructional materials for different kinds of learners not only from the studies of Hutchinson, Cotkin and Massa, Grover, and others, but from observations concerning changes in individuals which have resulted in field tests of materials such as the audio-tapes and the idea books. It is a common observation that some of the isolates and maladjusted children who do not ordinarily respond suddenly become alive and become excited about learning, when these materials are introduced.

Measures for Assessing Creative Achievement

Although measures for the assessment of educational outcomes are not commonly regarded as instructional media, they have such a profound influence upon instructional media and their use that it would be foolish to ignore developments in this area. Already there is considerable recognition of the need for achievement tests modeled somewhat after ability tests, but involving course content of course. In other words, people are beginning to ask for achievement tests that assess some of the new outcomes they are trying to achieve. Tests involving creative applications, judgments, and decision making are especially needed.

Educational research is quite strong and consistent concerning the fact that people tend to achieve along whatever lines they find rewarding. If achievement tests require creative responses, textbook writers and teachers will be motivated to find ways of encouraging this kind of development and students will store information in such a way that it can be used in producing creative applications,making judgments and decisions, and the like. In my role as an examiner of doctoral candidates in Educational Psychology, I have noted a number of rather interesting side effects from my preliminary written examinations. One part of the examination involves the reading and evaluation of a research article in their field of specialization. They are instructed specifically to make their evaluation both critical and constructive. In fact, they are asked to discuss other possibilities concerning the researchers assumptions, statement of the problem, hypotheses, data collection procedures and devices, analysis of data, and interpretation of the findings. They are also asked to think of ways in which information from the article could be used in their special fields. At first, almost all candidates devoted their energies exclusively to the production of a critical evaluation of the article. Over the past six years, I have noted some rather gradual changes in this respect. I must admit, however, that some candidates still ignore this part of the examination or do quite poorly with it.

Materials for Use in In-Service Education

Although I was discouraged for a while about the value of materials for use in in-service education, a number of recent occurrences have given me new hopes and I do not think we can afford to neglect this area. Some of the bases for my new hopes come from the successes of others in adapting and adding onto some of the materials which we had created and used with relatively little successs. For example, we carried out one rather ambitious in-service education project in which we evaluated changes in pupil growth in creative thinking ability and creative writing. We produced a manual entitled, "Rewarding Creative Thinking," specially for use in this project (Torrance and Staff, 1964). We also assembled a collection of ideas for developing the creative thinking abilities through the language arts in the intermediate grades. The major theme of the in-service education program, however was the consistent application of the following five principles:

1. Be respectful of the unusual questions of children.
2. Be respectful of the unusual ideas children present.
3. Show pupils that their ideas have value.
4. Encourage and give credit for self-initiated learning.
5. Give opportunities for practice or experimentation without immediate evaluation.

We were somewhat discouraged when we found that some of the control teachers used more of the experimental procedures than did the experimental teachers and that measured creative growth in favor of the experimental teachers was not altogether impressive.

A number of other practitioners and investigators have reported success with some of these same materials, however. For example, Enochs (1964) at the University of Missouri designed an in-service education program in which he used the manual on "Rewarding Creative Thinking" and encouraged the consistent application of the five principles listed above. In addition, he used an audio-video tape device of a mobile type. The experimental teachers watched and listened to these tapes and discussed them with the investigator. The discussions centered around the consistent application of the five principles for rewarding creative behavior. Enochs found that his experimental teachers showed changes in attitudes and classroom behavior not shown by control teachers. The pupils of the experimental teachers also showed greater growth in originality and flexibility but not in fluency.

Currently, I am creating for The Instructor magazine (Torrance, 1964) a series of workshop ideas for creative classroom teaching in the elementary school. Each month, teachers and school staffs are encouraged to concentrate on a dfffferent idea, skill, or attitude. If taken seriously, I believe that these materials could have some very productive outcomes.

Lessons from History

In encouraging the development and evaluation of instructional media designed to evoke creative responses and facilitate creative growth, it is well to recognize the many obstacles deviations from accepted instructional media almost always encounter. I think two of the most serious ones are symbolized in the Braille story, the subject of one of our audio-tapes (Cunnington, Myers, Buckland, and Peterson, 1962). Even after highly successful field testing for five years, Braille writing was not accepted for use in the education of blind children. Two powerful forces were responsible for this. The training schools fought the introduction of Braille writing because it would mean that their teachers would have to master new skills. The publishers also fought it because they would lose their investment in the enormous embossed books that were then in use. Although we find healthy attitudes among some teacher education institutions and publishers, any marked departure in instructional media from conventional materials is likely to meet with the solid and combined opposition of both groups. From personal experience, the standard routine seems to be for the publisher to consult selected experts from the teacher education institutions. The expert then declares the innovation invalid. If the innovator is unwilling to accept this judgment, the publisher then consults some of the rank and file of teacher educators who declare that they would never select a textbook having such innovations.

These forces are perhaps strong enough to prevent support of research to test - textbooks, but there is no reason why we cannot make some advances along these lines with some of the more inexpensively produced children's books, research reports, and the like. Quite briefly, the following is an example of one kind of experiment which I believe would be useful. The experimental materials would involve alternative forms of rewritten versions of journal articles. One variant might be a simple rewriting into the first person. Other variants could involve the injection of some of the textbook ideas already outlined. If these ideas proved to be successful, they would certainly be useful in constructing edited volumes of readings of research studies for instructional purposes.

C: I have been particularly interested in learning about the materials Paul has been passing around. In trying to figure the impact that they had on me and that they would be likely to have on a child, it seemed to me, if I was to try to summarize it in one word, it would be that they would have a loosening effect. It seems as though they could do a good deal to break up rigidities and to help a person to think and feel in ways that were somewhat different. It leads me to think a little bit about the thought that I've often had vaguely before that the creative person is a loosened person. He's a person who is more in process than most of us are. One of the things that I have been feeling in recent months is that this is essentially the problem of our culture at this point. I don't know whether all these things that I'm saying will hang together for you, but they belong together for me. It seems to me we have a big stage in history where an incredible revolution in the way of looking at life has got to take place. That is, up to this point historically, it's been perfectly all right to have static goals and static concepts. Life didn't change that much during a generation. If you learned some good things at the beginning of your life, those

5

would hold you through to the end. If you had learned what knowledge existed early in the game, by and large that would last you through your career. It seems to me that culturally we have come to a point where that is no longer feasible, that is, if you think in static terms and live in static ways is sufficiently self-defeating as it will be self-destructive. I don't think our culture can survive unless we can somehow change to a processed way of living rather than the standard way of living. It used to be that we acquired the kind of values we use and supplied our habitual ways of reacting as part of your educational system. Now if we become cast in process terms, we're going to become extinct. I really feel quite strongly that, I'm sure we're all very well aware of the fact that the increase in knowledge and technology is on an extremely rapidly upward accelerating curve. Now we're faced with the very difficult threat to know whether the culture can adapt rapidly enough to that changing situation. And certainly one way that I've put it for myself is that changingness has got to become a part of the central core of life for the individual and for the culture. I don't think that this has ever historically been true or necessary, or perhaps it has been true in some time like the Elizabethan period but it has not been necessary. For the individual and this is certainly for the culture a frightening concept and a frightening way of being. That's why I think of things like this as being one approach and I guess only one approach to the problem of how do you get people comfortable in living in a loosened way. For me this has parallels in the field of therapy and in an intensive group experience. I came back from a workshop a few weeks ago that had been a very moving experience for all of us, including all of the staff as well as the participants, and I could sense in myself how much more loosened I was, how much more perceptive I was, and sensitive to things going on about me, and open to new ideas and so forth. It's that kind of capacity for open loosened, process-type of living that we've got to achieve. I've seen some of that too in Peace Corps volunteers who have returned from living in another culture who found out there an open-minded way, and then they came back not very well adapted to living in our culture. Perhaps less well fitted by the experience. They were open to more things and open to some of the deficiencies in our way of doing things. I suppose the question that for me is completely unanswered is, is it even possible to learn to be comfortable in a processed way of being when everything in it seems to want to drop back into the system, into the status quo, into the known comfortable situation? I sometimes think the only characteristic of an institution whether we're talking about a religious institution, your educational institution or any other, is that it rigidifies and solidifies and keeps things unchanging. Well, I guess I feel that we can't afford any longer to live in those ways and I guess the only, really adverse reaction I have to what Dr. Torrance has been presenting, and it is no criticism of him, it is simply that this is fine as far as it goes. This has got to be multiplied hundreds of times, it seems to me, in order to have enough of an impact on us as individuals and on our culture. In this way we get comfortable with the changing quality that life is going to have.

C: On this last point, could I just ask you if there aren't at least some postulated advantages all the time for living in certain habitual ways? It's supposed to save time to be able to not to have to think, make a decision on each thing you do, and so forth. You do certain things just by a matter of habit and that apparently by a freedom of making routine decisions and so forth gives you time to do some of the other things. Now, this is almost somewhat contradistinctional to what you just said but these habits or these routines that we get into serve useful purposes as well as channel our thinking.

C: I'm sure that some of them do in that respect. I've always been impressed with Maslow's chapter on the self-actualizing person in one aspect that I was thinking of here. He says people that he selected as self-actualizing and shared with his selection were people by and large who fitted in quite conventionally into most aspects of life in order to buy their freedom to change and be creative in other areas. At least this is my interpretation of what he was saying. And I think that there is truth in that. The only thing I would say about it is that in these days there are relatively few things like that, things like brushing our teeth and dressing and things like that can be safely relegated to habit with a pretty great security that they won't change. Take something that is firmly rooted in all of us with a Puritan-type tradition, that work is a very good thing. It seems as though nothing could change that. Nobody is going to have to change it. People are not going to be working a generation from now, doing what we think of as work. So that a lot of the things that we've absolutely taken for granted, that no one would challenge are being challenged.

C: It seems to me that there are certain conventions that we've adapted. We drive on the right hand side of the street. We use language in a certain way. We don't spell words all uniquely just to be creative. We have certain laws for taking care of rules of health and courtesy and other things. Now, I admit there is a limit to this but we just can't throw all of these things out and say that now, we're going to just change everything. Everything is going to be a problem and we're going to have to solve it in a unique way. Schools have many other functions to perform, many social functions. They aren't only for the development of problem solving abilities. These aren't the only functions of the schools.

C: Well, I must say one more thing on that, and that is that I may see this problem in an exaggerated form. Of course there is the idea that there are things that make life routine because we all do them in the same way and all that. But unless I mis-read the signs of the times the most important conceivable goal of education is learning how to learn, or learning how to change and to adapt to that goal in our present-day world situation rates far above any type of static knowledge that you could name it seems to me. You could say, well, we've all got to know mathematics, etc. Whoever thought that we would be learning a new type of mathematics, even in the elementary grades and so on. I guess one reason I don't stress the things we do is that I feel I'm not worried as to whether schools will impart a certain amount of commonality of learning. I am sure they will do that. My big concern is whether they will manage to achieve in the individual learner it's capacity for change, willingness to change, openness to change, which it seems to me is exceedingly crucial. I feel the present change in our political scene is just an example of one of the present trends in our political scheme. It is an example of the fact that people are frieghtened of change and there is a continuing tendency to pull back. Let's not change. Let's stay as we are. I don't think we can be valuable as a culture if we seek that out.

S: One of the things that I have observed, and it came out very strongly when I asked my students at Berkeley earlier this month to try to recall some episodes from their own teaching experience in which they had encouraged or permitted creative ways of learning and had resulted in some marked change in their achievement or behavior. Eighty-two per cent of these people were able to do it. Almost all of them reported that when they bent just a little bit and permitted a child to learn according to what seemed to be his natural bend or in a creative way, it was then that their behavior became more conforming in various ways. One very delightful example that I like was given by a teacher who was in her first year of teaching. She was teaching fifth grade social studies, and she said, "I did everything the book said in teaching Latin America." They were choosing countries to report on and to work along and he preferred Ecuador but two other children had chosen Ecuador so he didn't offer to participate. She inquired and found that the first child had become interested in Darwin's discoveries related to Ecuador, the Galapogos Islands, so she said: "WEll you go ahead and study the Galapogos Islands." Then her problem became to get a report out of him. After three weeks he had still not made any progress on getting his report written down. He was just too busy talking to anthropologists at the University of Californa and reading books and thinking and asking questions to get anything written down on paper. So finally she decided that if she was going to get a report out of him, it would have to be an oral report. And he turned out to be a brilliant creative teacher for the children, resorting on such things as showing the different conditions on the islands and asking them to guess what kinds of species were created by those conditions, and so on and so on. He turned out quite brilliantly and they all learned a great deal from him. Then the next time around she was able to convince him to do a written report. He was interested in baseball so she used the switch-hitter concept for posing the situation that he was a left hander and needed to try being a right hander so that he could switch hands. So the next time around not only did he write his report, but he spelled it correctly and even added a very proper bibliography. These were certainly conforming skills which I'm sure will pay off.

C: Well, we call our own lab, the lab of unroutine. Anytime anything becomes routine in a sense, we turn to the routines of letting computers do the routine part for us, exaggerating a little of course. And in a way this may spoil some of our people for later predicaments they get into because they are sure to get much more into the situations of routine.

C: I'd like to raise some questions about your observations concerning the discontinuities in creative development. If I understood you correctly, I got the impression that you thought these were rather unfortunate,that they could be avoided, they weren't genetically or constitutionally determined, and that if we would only continue to let children have the experiences that lead to natural ways of learning, they would continue to develop creatively.
Let's nurture the kinds of performances on your tests which bring out creative potential, creative response, this would be better. But we have evidence to suggest, it seems to me, that perhaps some of these discontinuities are important and valuable if a person is going to be a creative individual. It may be that these discontinuities are important, have been important in the past because of the way society is structured. But I am not inclined to think entirely of that. In an earlier study which we made in the Institute of individuals picked because they were of emotionally sound, personally sound and emotionally stable individuals, and we found that those who are so designated tend to grow up in the same community. In the same four walls in early life, in the same family and in the intact family unit, there was a great deal of harmony within that unit well integrated into the social community. The less stable individuals had had less fortunate experiences. When we came to study highly creative individuals we find a tendency of these individuals who lived in families where

they have moved from one house to another house in the same community or moved from community to community, and very often moved from one country to another country involving some cultural discontinuity. The family is frequently finding itself different from other families in the neighborhood, experiencing a certain degree of cultural dislocation. These are individuals of the rather unhappy family at least as they reported upon certain kinds of happiness. Isolation tended to make them turn in upon themself to give them some experience of their inner-living and interested in symbolic processes etc. And I am wondering if perhaps this isn't important if individuals are really going to be highly creative. Certainly it pays off for the important individuals we had the opportunity to study. Furthermore, you point out that at these ages where you see a drop often in creative development, that in fact they are more often psychiatric referrals. I think that true. I think for example of the early years. This is a period where a child is developing language skills and language competances, motoric skills which permits the child to express more independence. And very frequently the child who expresses independence, uses that wonderful word "no" frequently in a negativistic way, shows that negativistic behavior which a lot of people describe as a healthy outlook. It seems to me that it's perhaps valuable and helpful for individuals to learn to grow up, to express their hostility, maybe as being foreseen by others as being trouble-makers because of this but I wonder if this doesn't contribute somehow to rapport of development. I'm wondering if perhaps you could have an educational system where if you give children an opportunity towork with your materials which I'm sure are fun for children, every year all the way along they wouldn't miss something which would come from being forced perhaps to put a little bit more emphasis on convergent thinking rather than divergent thinking, being held to tasks which are frustrating and less interesting, causing them to perhaps show less smooth adjustment and smooth behavior? I don't know what the answer is but at least I raise a question about it.

S: Well, I have several thoughts about that. For one thing, I'm convinced that we do have to give attention to judgments decision-making, and convergent kinds of problem solving. You could never ignore that. It has also occurred to me that one of the other ways that we might productively and creatively look at these discontinuities would be as opportunities for teaching children to be more comfortable with change. This is a positive, creative thing that I think our education and our society could introduce. I am sure that many of these highly creative individuals have had to learn to be comfortable with divergency. This is one of the things that occurred from these experiences of living in different cultures. I am particularly interested in a number of things that Pearl Buck has said about her own experiences whereby she became comfortable with being different and was able to tolerate being different. And to be comfortable with change. I see that as an alternative and as a more productive possibility.

C: I think also the children you're speaking about have had more experiences in solving problems. They had more problems.

S: Yes. We found that also to be true of the jet aces that I studied following the Korean War. They had encountered more failure; they had encountered more problems and they had had to fight all of their lives.

C: They're the ones that came through.

C: This may sound old fashioned but I have a feeling that perhaps in our desire to have the ideal kind of social human interaction aren't we in danger of trying to make things too easy for our children.

C: I'd like to make a comment on this. In our courses, when we teach a person to come up with a hundred alternative ideas let's say that solves our problem, you want to see frustration when we ask students to take those ideas and develop them into a plan of action. This is more frustrating and requires more discipline /for the person than any other kind of discipline matter. In other words, when you carry it through to a conclusion, we don't mean just the fun of picking up the hundred ideas, but in culminating them into a plan, a workable plan, and so on, you get the discipline you're talking about and I think you get an even more rigorous kind of discipline in carrying it through.

C: It seems to me like a valuable note that you've added. Both yesterday and today you were talking about the fact that creativity doesn't necessarily always come out in sweetness and light. I mean it can come out of difficult situations and be overdisciplined and all kinds of things of that sort. Out of privation and subtlely forced cultural change and effective elements of that kind. The reason I feel sympathetic to what you were just saying is that if we are interested in enhancing the degree and level of creativity in children adolescents, or young people, we know that we are not going to plan the kinds of difficulties and privations that may in many life experiences have led to creativity. We're not going to plan the kind that have existed in the past. It does seem to me that if a certain degree of tough experience in meeting with difficult situations is an element in creativity, it's got to be built into our educational planning in socially acceptable ways. This is why when a person meets frustration trying to chose one way out of a hundred ways, an exercise of this sort may be a useful kind of thing where you are not going to say, well, you should move the family to two or three different cultures in order to increase the creativity of the children. We can only see that as a possible fact growing out of circumstances, but we won't be able to plan it that way.

C: Aren't you asking in order to produce this kind of a person, creative problem solver, what is the nature of our support? Do we merely want to make him feel comfortable? Or, do we want to make him feel uncomfortable? Now, the question comes up, how uncomfortable do you make him and still support him? And just where is the nature of this support?

C: I think if indivdiuals are going to be highly creative they are going to have to have some measure of discomfort. We talk about divine discontent and there is something that is driving and motivating these individuals who will set for themselves a very high task, who will tolerate so much tension and so much displeasure in striving to the end of the highly paid achievement after many many years. I don't think we're going to create this kind of person by mostly trying to make people uncomfortable. I'm not saying that at all. But, I am wondering whether or not Paul Torrance should be as concerned as I think he is about the fact that there are sort of plateus in the development of a child in school. Of course there are certain periods where the ego needs ego incentives, using Freud's term, are operating more strongly and coming into being as though there's going to be more conflict between these controlling and inhibiting mechanisms and these subliminal impulses of the child. There has got to be some kind of interaction between the primary process and secondary process to use another Freudian term, and I think these opposites within the individual that he is developing will from time to time experience a sudden discouragement, conflict, and tension. I'm a little afraid that maybe some think that we can spare individuals these kind of experiences. We can't spare them these experiences, anyway, they are going to have them. And therefore, we should do all we can to support the individual. I at least want to get this kind of concern on the record.

C: There is a minor variation in this. I think it is this business of open versus closed systems. I couldn't help but think again about this thing what may appear to be a closed system may eventually prove to be an open system. It wasn't open maybe inside this particular part of the setting. That is, a person may be in a setting in which the closed system comes down on him and he is uncomfortable or dissatisfied or something like this. Because, now as I said earlier, when he gets out in the hall, when he goes home to his own inner life and writes in a diary the messages to himself or something of this kind, I think he's got an openness to the system sometime later some way out, or something that showed that this whole closed system didn't have complete control. Maybe it's one of these kinds of things that comes at some other time, some other way; and this closed system helps bring it about where if you had an open system, you wouldn't get such reactions.

C: I should like to suggest that Paul do follow-up studies, if possible, mainly some years hence to go back and study these individuals who showed the discontinuities compared to those individuals who did not show the discontinuties and see at what level they have functioned some years after.

S: We have some who stay the same; others who show no drop. Their development is continous, and others who show drops and recover, and some who don't recover. These latter two groups are the ones that I would be particularly interested in studying in the future. We have some from our longitudinal data now. Those who show the drop and don't recover are the ones that I'm most concerned about. But there are those who recover and the majority of children do recover in the 5th and 6th grade.

C: There are two things I would like to say. One of the things that anyone who has dealt in an elementary school has observed is the discipline problems. Pupils change at the 9th year of age around the fourth grade. Youngsters are very realistic so all the rules have to be held almost you know there's just no give to them. There is no give on anything. Either it is or it isn't. You know, they've been around long enough now and they think they know the world and so they are managing it. But it has to stay steady for them. Then, again, if you'll look at the child development literature, at least the older literature, you find great stress on the growth spurts, that is the pre-pubescent growth spurts in terms of whatpupils do in school. And you find those who haven't done anything some place between 9 and 11 seem to make quite a spurt and you have youngsters suddenly going up in arithmetic, reading and so on. So I think this is deeper and encompasses more than anything that we might label for the moment as creativity. I think it's a part of the growth process in a very meaningful way that we yet don't know.

C: I too have been wondering about this so-called fourth-grade slump and what could be the cause for it, what external factors might account for it rather than changes within the individual himself. I am convinced about the fact that we have the elementary schools divided into the primary years, first, second, and third grade, intermediate years, fourth, fifth, and sixth, and junior high, or seventh and eighth, and if thekid has any difficulty in reading or achieveing in the first grade, the parents are worried about this. The parents are told "Well, he'll recover in the second grade. Just give him a little more time." Then if he is still not doing so very well in the second grade, parents are told, "Well, there's still the third grade, in the primary years, so let's not get too anxious about this." But from the parent's point of view, if he still can't read by the time he gets to the fourth grade, they know that some drastic measures have to be taken. If he is misbehaving in some way they can't overlook this anymore. So it is the fourth years, the fourth grade is a kind of a critical time to take him to a clinic. The parents can't wait anymore. And you may get some of these external factors that get the kid more recognition than he deserves simply because of the fact of external pressures. The school counselor now has been brought into the problem, the parents are brought into the problem, and the kid may still be doing pretty well. But society is getting worried about him. I don't know whetherthis makes any sense or not.

S: Of course, there are a lot of other things that characteristically happen to children at this age. Instruction is more formal. Children have to sit in straight rows with their feet flat on the floor; they are given homework; they have more monitors; they start having student government and children monitor one other's behavior; they become very concerned about consensual validation from their peers; they go to the peers to check their information rather than to adults.

C: We approve this, too, by virtue of the fact that we set off the forth grade as not being really a part of the third grade. The fourth grade now is a part of the fifth and sixth.

S: Many fourth grade teachers will tell you frankly that I have no idea what goes on in the third grade. We also train fourth grade teachers differently from third grade teachers.

C: Right. This I just want to get in the record.

I noticed in your "Can you Imagine," you had two booklets, one for the student and one for the teacher. And the one for the teacher was three or four times fatter. This goes back to my first comment. Instructions to the teacher may be because you're proliferating them, your instructions to the teacher are much longer than the materials themselves.

S: Well, we want to give them a variety of ways so that they will not feel that there was one right way to deal with them.

C: Nonetheless, you did recognize the importance of instructions by teachers for the materials to work some way or another.

S: Yes. Well, we're convinced that in creating materials, we have a responsibility for giving teachers guidance in the use of the material and even this doesn't guarantee that they are going to use them.

C: So you have to give them that amount of material proportionately in order to provide them with all of these alternatives. You've got to provide them with all of these alternatives in order to make the materials appear clear.

S: When you give them all these alternatives then it makes them think of other alternatives. That has been the promising thing to me. Teachers tend to use materials automatically if you dont' give them anything; but it has been our observation, and I want to check up on this, that after you give them suggestions they are more likely to diverge themselves and use them more imaginatively.

Chapter 7

INSTRUCTIONAL MEDIA IN THE NURTURING OF CREATIVITY

Donald W. MacKinnon, Director
Institute of Personality Assessment and Research
University of California

S: As you know I have been asked to talk about what I consider to be the implications of our researchers at IPAR (Institute of Personality Assessment and Research) for nurturing creativity through instructional media. I want to start by saying that any talk which I am going to engage in about using instructional media to nurture the creative potential of students must be prefaced by the recognition that at least I have no certain knowledge as to how this can be accomplished. I think some skepticism has come out in other discussions, too. This is not to say that we don't know anything about the creative process or the creative person, but the difficulties in my discussion lie in the fact that the subjects of our investigations have all been mature, highly creative individuals in a number of fields: engineering, research science, mathematics, creative writing, and architecture. To what extent we can generalize from our findings with such mature, creative and productive individuals to students in school I do not know. I would point out that our subjects told us in rather extensive life history, psychiatric-type interviews about their early years and especially about their experiences as students. But I think we have to remind ourselves first that these are self-reports, but retrospective self-reports subject to the misperceptions and the self-deceptions of all self-reports. Secondly, I think we have to remind ourselves that the conditions in school and in society which would appear to have contributed to creative development 15, 30, or even 40 years ago might fail to facilitate creativity or might even inhibit it if we were to establish them today in our quite different world. Furthermore, we do not know that the traits which distinguish the creative workers whom we have seen as adults characterized them when they were young students. Nor, can we be confident if we find students today with the same patterns of traits that we shall thereby have identified those who will be living productive, creative lives some 15, 30, or 40 years hence. Finally our uncertainties are compounded by the fact that none of our creative subjects ever experienced any instructional media in the sense of educational television or film strips or teaching machines, and the like. Whether their creative potential would have been nurtured or inhibited by such instructional media I do not know.

Now if I want to move beyond our own findings to talk about the implications of other researchers on nurturing creativity, I must point out that I am equally concerned about the relevance of the investigations of those who have worked primarily with children. I have the highest respect for Paul Torrance and his work, and for that of other investigators, but I must say, if we are really thinking about persons who are going to be effectively and productively creative, I am not entirely convinced that those individuals who in schools today do well on the Guilford tests or on most functions of them by Torrance and others will necessarily, when they become young adults or middle aged adults, really turn out to be creative individuals. They may be very spontaneous; they may be very free-wheeling; they may be healthily extroverted, but will they in the long run turn out to be creative?

C: May I comment on this just a couple of ways? For one thing, I go along a little with Malcolm Provus that the tests in the form in which we now have them may be too highly verbal for certain fields of creativity. These kind of thinking tests ought to get to less verbal fields. The second thing that I have sometimes said in our own studies and yours which have been on mature people are getting some incidents on these people and tunneling backwards, whereas

Paul Torrance is taking some thinking tests and tunneling forward. I just am not sure what we are going to get. I'm sure we're not going to hit dead center. And I'm not sure whether our tunnels are going to meet.

C: We have been using the same instruments that have been used with people in occupational fields. We use the same instruments with teachers and we observe their behavior and got these differences in kinds of questions that we got. We also used the same kind of question with the students, and we found the non-verbal figural abilities tests identified different kinds of individuals from the verbal tests. That's very clear. It's also clear that children in New Delhi, India, were disproportional on verbal but not on non-verbal, but in Western Samoa with the Negro in segregated schools it's the other way around.

C: Well, if I were to be asked to formulate a program for spotting the creative, I think I would go after it by two or three or maybe more types of studies right now. Types we can get out of our studies of adults, types we get from verbal thinking tests, and types we get from non-verbal thinking tests. Spot all of these and then see which ones will materialize into what kinds of people are creative.

C: Furthermore, I would look for a different type even in a quite different group-- high elaborators vs. high on originality . Our inventory studies of high school seniors and college students show differences in the life experience of the high elaborators opposed to the high originals. And I think both of these are important types of creative behavior.

S: In just a moment I propose to say something more favorable, but may I continue to be still a little bit skeptical? For example, Paul pointed out that when teachers that were observed after this experience, they were asking more provocative questions. Now, I would agree that asking provocative questions is one part of being creative, but only part. For example, I've had a lot of provocative questions asked me at cocktail parties but they seldom lead to very much and so my question is this: Are they the kind of individuals who not only ask questions but are driven to find the answers for them? Now, I must say that of all the studies reported, I would agree with what Malcolm Provus said this morning with respect to Getzels studies, regarding some of the individuals whom were **there** described as being creative in terms of test performance. I would bet my bottom dollar that if those particular individuals are studied some years hence they won't all be highly creative. This is a purely subjective judgment expressed with my own biases and prejudices and I may be entirely wrong. But now, having expressed my doubts, let me say that I think the picture probably is very much better than I have painted it because there is a certain kind of congruence, indeed, a very impressive congruence between our findings and the kind of findings that Guilford has, that Torrance has and that others who work within this field have. And while we probably won't as Carl Rogers said, come out at exactly the same point as we tunnel towards each other from different directions I think that we're not going to be very far off. If I didn't believe that something like this is possible then I would really feel I ought not to say anything more about the implications of our findings for nurturing creativity in children.

Well, now if we abide by the proposed injunction not to argue about what creativity is, we're never going to get anywhere in this conference. I've observed that others have violated this injunction. Guilford violated it yesterday afternoon, and also Malcolm Provus this morning. So let me say what I think creativity is. I would agree with what J. P. Guilford said yesterday afternoon and with what Malcolm Provus said this morning. But I'm inclined to take it one step further and bring in elaboration. You may want to criticize this or reject it because today Paul Torrance has urged that we make a distinction between individuals who are creative thinkers and those who are elaborators.

C: I've included elaboration as one aspect of being creative.

S: Oh, I thought you were opposing the two. I'm sorry.

C: I think of originality or a group who are highly original, as having high originality scores but they do not have high elaboration scores.

C: May I conclude that elaboration is one variety of original production.

C: Yes, if you went after one single type like originality, form, and elaboration, you'd get a group for each one and this would not be congruent with the other group you went after.

C: One of the further steps that I would like to take in my career, I don't know whether I'll be able to, is to identify 500 children who are either high elaborators and the others who are high originals from the 20 or so thousand children that we have tested.

S: What I would point out is that as I see it true creativity fulfills at least three conditions. Complete creativeness involves first, a response that is original for the individual who is evoking the response. I think we'd all agree on that. But this is not sufficient. I would make the second requirement that this original or novel response or idea must serve to solve a problem. In other words, I define creative thinking as basically problem solving activity. But it is not just sufficient to have an insight that might seem to solve a particular problem, for I feel that if a person is being really and fully creative, he doesn't stop there. He pushes on concerned with an evaluation and an elaboration of the original thought, sustaining and developing it to the full. I think some people would tend to say this last step is different from creativeness and I don't want to press the point too much. The first two steps might generally be more readily acceptable. But to let you know where I stand and what I think, this is the way I think of creativity and this is the way I define it. The creative person is the person who engages in activities that are original, that are adaptive, and that are realized in his behavior and his performance. In stressing the fact of realization I'm putting, perhaps, a little more emphasis on a certain kind of endurance, a certain kind of persistence, a certain kind of perseveration than is frequently done in discussions of originality and creativity where much more emphasis is put upon spontaneity and moving quickly to that which is novel. Here I would point out that when we score our more creative individuals and our less creative individuals on the endurance key for the Gough Adjective Checklist, a key which measures the "need-endurance" as conceptualized by Henry Murray, we have come across this interesting finding that the less creative persons score higher than the more creative individuals. On this particular key they are more enduring, and more persevering. But if you look at the adjectives that constitute that key, it reveals this very interesting thing; namely, those individuals who are less creative when they have a problem, and when they become frustrated in their attempts at solutions, tend in a stubborn way to keep working at it--working, and working, and working--somehow being driven by their conscience to stick to it. For them to give up is to reveal a kind of weakness so they feel compelled to keep hitting their head against the stone wall. In contrast, highly creative individuals when blocked in a task will not give up immediately or even quickly, but they are much more ready to recognize the fact that they are blocked and turn to something else, go out and take a walk, turn to other activities, etc., then come back to the task later. In other words, it is a flexible endurance, a flexible persistance which these individuals manifest as against the stubborn bull dog endurance and persistance which less creative individuals show. In other words it appears that a period of withdrawal from the problem which was one of the steps stressed in the discussion of the creative process, followed by a period of insight, is very important. And many of you may recall that many years ago Morton Prince said that when a person has a problem and is said to put it out of mind, he actually doesn't put it out of mind; he puts it into his mind where it continues to be worked upon.

More recently, in 1950, Thurstone in that very interesting and I think all too often neglected paper of his on creativity, which he read at the invitational conference called by the Educational Testing Service, suggested that one of the traits of the highly creative individual might be the ability to communicate more easily with the less conscious levels of the mind, that he might have a greater capacity or power to dredge up from the preconscious or the unconscious material that is there. This led me in my investigations with highly creative individuals to use as a piece of apparatus something which may shock some of you, mainly the Ouiji board. I made the hypothesis that the more creative individual in the first place wouldn't be afraid of the Ouiji board or reject it as a fantastic or crazy sort of thing but rather would be willing to see if by placing his hands on the little table he could get via the Ouiji board the recall of some forgotten experience. The instruction to the subjects was to try to think of something which they knew they had once known but could not now recall. For example, the name of a girl they might have had a crush on in some early school grade, or the address that they had frequently gone to, or a telephone number they had frequently called, etc. It was suggested that the item of information which they would seek to recall should be one that originally had some emotional content or affective tone and that further the item to be recalled should be one which, if obtained by means of the Ouija board, could be checked. The purpose of this was to determine whether the recall by means of the Ouija board was a veridical one or not.

After a subject had thought of such a possible item, provided he could not recall it no matter how hard he tried, he was asked to place his hands upon the little table of the Ouija board. It was suggested that he relax as much as possible, putting himself in a state of abstraction and seeking in so far as he could to reinstate the mood and feeling of the time when the sought-for item of information had been well known to him. In this way, some fascinating and even amazing recall of earlier events and experiences were obtained by our creative subjects.

I mention my work with the Ouija board because it touches on a point which Carl Rogers made yesterday and which I think is an important one, namely, that in a great deal of our instruction we give our students rather short tasks to perform which they are to complete within a brief designated period of time. Students get repeated training of this sort, but they do not early enough or often enough get training in trying to solve problems which cannot be worked out within a short period of time and which require that the student leave the problem from time to time and come back to it again and again after such periods of giving up. It is in such moments of giving up, after frustration and failure, that not infrequently one experiences the moment of insight. The necessary item comes to one or one recalls some earlier known fact which can be used in the solution of the problem.

The Ouija board experiment involves the subject in trying to recall something which he is unable to recall consciously and demonstrates to him that, having worked hard at a task for a period of time, if he will only experience a period of relaxation and abstraction, the solution may well come to him then. What I am trying to suggest is that all of us have more "knowledge" than we know we have and would probably profit from learning how to get in communication with those unconscious elements of experience which are needed for the solution of our problems but which at the moment are unverbalized and unverbalizable. I am quite skeptical about the usefulness of psilocybin and LSD in this connection, but I do think that one can acquire an ability to tap the less conscious levels of this mind by experiences of the sort which I have described.

C: Did you get some evidence through the Ouija board which you can report on?

S: Yes. One of the most fascinating cases was that of a well-known writer who tried to think of the name of a girl on whom he had a crush in the eighth grade. He tried very hard to recall her name but without success, so he turned to the Ouija board. Almost immediately the little table began to move very rapidly from letter to letter. As was my practice, I stood by watching the letters over which the point of the little heart-shaped table stopped, recording the letters in the sequence in which they were indicated. In this instance the table moved rapidly from letter to letter, at times pausing longer over given letters. Other letters were pointed to between those over which the little table rested longer, and reading the whole list of letters to which the table moved one could find no sequence spelling out a girl's name, but when one read the letters over which the little table had paused longer, they did spell "Thelma."

After some time the subject broke off the experiment saying that it had not been successful. I then asked him if the name "Thelma" meant anything to him. His response was that it sounded vaguely familiar but he could not say that this was the name of the girl in question. Later he was able to check with his sister who recalled the girl and he reported back that according to his sister the girl's name was indeed "Thelma."

In another instance, an architect tried to recall the telephone number which had been his wife's number before he married her. He reported that he could not recall it although he kept thinking that the exchange was

"Washington." Failing to recall the number, he put his hands upon the little table on the Ouiji board which, moving almost at once, spelled out the word "Federal," followed by a series of numbers. The architect was subsequently able to check the veridicality of this recall and reported back that it was indeed his wife's number which "the Ouiji board spelled out for him!" I think both of these cases beautifully illustrate that it is possible in certain periods of relaxation and abstraction to experience what one cannot experience when in the conscious, waking state one is striving hard for it.

C: Then you think that maybe some of your people would have been better at this than less creative persons?

S: Unfortunately, I did not have an opportunity to administer the Ouiji board procedure to the less creative members of the professions which we studied. Thus, I cannot give you any exact answer. All I can say is that I was impressed by the frequency with which these mature, highly creative individuals were able to obtain lost memories by way of the Ouiji board. There were, of course, exceptions. For example, one creative woman mathematician was made so anxious by having to place her hands on what she referred to as "this devilish machine" that after a few seconds she fled from the Ouiji board back to the safer area of the armchair where she had been sitting before the Ouiji board experiment began. In brief, though, I think the experiments confirm the notion, which many have expressed, that there are certain kinds of training and certain kinds of experiences which will enable a person more effectively to get into communication with the more preconscious and unconscious levels of their mind. This, of course, provided that they first, through hard work with difficult problems set up enduring psychic tension systems corresponding to the tasks which have frustrated them.

C: I have one unresolved thing I want to get on the record and there are some clear-cut examples of what would be called long sustained effort on a single problem during which one finally gets to the problem with no great evidence that there is a long period of incubation. That is, it is a long sustained effort, without the incubation and you're arguing a long sustained effort to get into the problem and then incubation. I would bet, of the two, on at least the long sustained effort to get far enough into the problem to get enough of the things you are juggling with where you then continue it consciously or not or give it a period of rest.

S: I think you've got to struggle with the problem some time before you retreat from it. This is what seems to be the report of these creative individuals. They don't just think about it but work at it critically. Otherwise I don't think anything is going to come in the period of withdrawal. One has first to struggle with the problem and possibly make some progress towards solution of some aspects of it before retreating from it.

C: Some were reported going right through with a long sustained effort; there was 30 or 40 hours or so. Maybe they call eating a period of this sustained effort.

S: Well, there were some who did that but those who intended to work in this way, refusing to give up in this dogged stubborn fashion tended to be the less creative subjects.

C: Was this thirty or forty hours without sleep?

C: No, but you know, without serious interruption, completely freed from the usual weekly pressure. Land and Shockley both report this.

C: It sounds like you have an inflexible rigid kind of resistance and a flexible kind of resistance.

S: Well, you know through some of my papers that our less creative architects think of themselves as primarily conscientious. They feel that to give up early in attempts to solve problems is a sign of weakness. They've got to keep working. Those who, on the other hand, are more spontaneous and freer in going out of the field are the ones who come back to this task with the creative solution.

What I want to do now is to suggest that films and educational television can be tremendously helpful in furthering what I think everyone agrees is the first phase of the creative process. I would describe it as a period of preparation during which one acquires the skills and techniques and the elements of experience which make it possible for one to pose a problem to himself. I don't think there is going to be much creative activity unless the problem is proposed by an individual to himself. But one is not going to pose a very significant and important problem without considerable richness of experience, a period of preparation during which one acquires the skills, techniques and other necessary elements of experience. And it seems to me that television and films properly devised can be tremendously helpful in what one might call the in-put phase in furthering the necessary experiental elements for subsequent creative thought and action. The limitations of television and films are many and serious, but as techniques for clear and detailed presentation of a rich variety of material and as a tool for demonstrating skills and techniques at close range they're almost without peer. A few weeks ago I saw a magnificent Russian film on a large panorama screen of the Sleeping Beauty Ballet with the Leningrad dancers.

It was so large that you could see the technique in clear detail in a way which you could never see it even if you had a front row seat in the theater. Educational film and the television have marvelous possibilities along this line which I would like to stress. A student who has not learned to see and to listen can never require that richness of experience in the absence of which one cannot be creative. The more items of information the person has the more likely on purely statistical grounds it is that he will be creative. The creative fact is, in large measure, the associating or the putting together in new and fresh combinations the elements of previously acquired experience. The more combinations one can form the more likely that some of them will be creative. The combining of items of information and new constallations serve not only to solve problems but also to create them. It is so quickly and so effectively increasing the child's items of information that television and films can contribute significantly to the nurturing of creative potential. I'm being much more positive about some of these things than our expert was this morning. I may be naive in thinking these things can be so easily done. It has often been my experience when I am talking rather informally with people about creativity and television to hear them say that "Television is a horrible thing. It can never foster creativity!" In contrast to such views, I am struck by the differences which I have observed between my own daughters growing up without benefit of television and now my grandchildren growing up with it. The sensory,perceptual, and ideational in-puts which my grandchildren are getting as a result of television is ever so much greater than that which my own children had. Of course, there can be bad input but I'm tremendously impressed by the amount of information that children can pick up even when they seem to be not paying very much attention to what's going on on the screen. Again and again I am amazed by the clear information they have gotten obviously through what they have experienced on television. So I am not one of those who is troubled by young children spending time watching television; I do not think that it is a waste of time.

C: I guess one comment I would make is that in regard to this whole business of making more complete use of the unconscious, some of you may have seen the paper that I wrote in which as an analogy I used the notion that if you think of the total organism, the total human organism as somewhat of a pyramid, consciousness, after all is the very latest development in an evolutionary point of view. Remarkable as it is it still gives us very little knowledge of all that is going on inside. We get conscious knowledge of someone's sensory input from outside and some of the input from the inside ourselves but I think we can overestimate the importance. And if we could live more fully with our total organism which I think is expressed in terms like the unconscious even though I'm not very fond of that term itself, we could live more richly. The thing that's stimulating to me about what Don MacKinnon has said is that except for experience in therapy and experiences of that kind, I hadn't really thought much of trying to specifically develop techniques which might enable persons to live more closely and fully with all that's going on within them. And that's why this Ouiji board thing really hit me. Not that it's that remarkable in itself but if we took that as an opening wedge that there might be many ways that a person could tap more fully the organismic knowledge which I believe we possess. That is we are a great deal wiser than our intellect and unfortunately a great many people don't recognize that, particularly intellectuals as college professors, I feel. And I cannot be aware of how much.

we possess of the much greater range of wisdom. So I'm intrigued by that and the way it has come home to me in recent years. If one is willing to trust one's inner processes one acts in ways that consciously seem strange and often proves to be surprisingly apt and sound. What I am talking about mostly is experiences in therapy where I've learned to trust the kind of phrase or image or fantasy that comes to mind. It may seem to have nothing to do with what's going on. I've learned to trust that and express it and often times I'm speaking of something very deep in the other person that I wasn't aware of and that he wasn't aware of until I had been willing to voice this. So I feel fully convinced of its potency and I'm sure this is the same kind of process I was speaking of yesterday when I spoke of writing on scraps of old paper. I mean you sort of tease out things that you don't know yourself in that way. Well, that to me is the most exciting thing that has been said and I hope that others can push that aspect of it further.

Also, I'd like to stress on endurance. I think endurance probably is an overlooked quality in the kinds of creativity that are socially useful, at least. It may be other types of creativity that could be defined but socially useful creativity is apt to have that in it. In fact I've felt in a slightly clinical view that the creative person is one who had an idea and has pursued it long enough and persistantly enough that he becomes known for it and recognized for it and so on. That is, I feel this particularly about art for example, about which I really know very little, but a person has found a style of presenting himself if he only painted one picture, I'm not sure at all if that would be regarded as a great artist, particularly creative, but may persist in showing that style in a variety of forms. Then he comes to be recognized as a creative person. Oh, yes. I was going to say one other thing when I was talking about the statements about the conscious and unconscious. I think I mentioned to someone once here yesterday that I've been interested in my association as a consultant to California Tech. with the fact that one of their leading theoretical physicists is really deeply interested in psychology, so much so that he even considers from time to time whether he might shift his field. He feels he is an old man in theoretical physics because he's now 34, so you might ask is it possible in psychology to make contributions at a somewhat older age? One of the fields he would really like to turn to is the unconscious and I said why and he said: "Well, I feel that's where the mystery lies, I really feel that that's where the mystery is and so that's the area I'd like to attack." But then he said: "Why is it that when I talk to psychologists about the mystery in their field they all sort of pull away?" And I said, "Well, you don't know psychologists very well!" But he does, of course, I meant it that way, he does know that psychology is terribly uncreative. But this does have to do with the whole discussion of creativity, that this really creative scientist in a field that is a secure field doesn't feel they've got to somehow make their way as a science, quite naturally and spontaneously turns to the mysterious as the thing he would like to investigate. We're all too often in our field , so it seems to me at least, go plodding ahead very fearful of getting out of the approved rut and it was very refreshing to me to find such a person. The other thing he would like to investigate is hypnotism which has an equally good reputation among psychologists. Those are fields in which there is mystery and if you could ever resolve part of the mystery, you'd know a lot more than we do now and he has that kind of attitude that would feel that first you go to the most mysterious and least understood part of a field in order to make progress. So this as I say was quite refreshing to me.

There is another kind of challenge ahead that many of us don't know much about and this is that there is some kind of a partial wedding or something between interaction type lead and the growth that a person might get through attempts to develop his own creativeness on his own. And we may have to call upon the hope that someone like you who's found work in both fields as possible leads. You were talking about working all alone and then you were talking about the growth one gets from certain kinds of group interaction. So there may be a fluctuation between them.

C: That could very well be.

C: We need someone to help us think through these cross areas where people are not inclined to think.

C: This is very true. I feel both ways on that. For example, I feel very keenly that participation in an intensive workshop kind of experience of basic encounter as a kind of experience that loosens people up in ways that makes them much more creative in the interpersonal relationships. And it seems to me that I feel quite sure of this. Does it also make them more creative in other areas? I don't know. It seems to me there is a real possibility of it because I think any time that we drop our defenses and open ourselves to the world as it is, both within and without, that we are more likely to be creative.

C: I'd suggest that there is the possibility of the diminuation of creativity if such interaction results in a watering down of the values which provide us with our incentive and perseverance. You might go both ways. Others influence you and so your old ideas no longer hold the conviction that you might need.

C: Could this be an example of what you mean? I know that the effects on a couple of physicists being in a workshop type experience has caused them to lose a considerable amount of their motivation toward physics and turn them in the direction of an interest in interpersonal relationships. I simply thought of that as a shift in focus of creativity rather than necessarily a decrease in their motivation for one type of creativity.

C: Now, you have to be a bit impulsive to be creative. You may be less impulsive after being interpersonally stimulated.

C: After being what?

C: After having greater interpersonal confidence. No, by and large, the people in the natural sciences have not cut off their challenges in social settings. Maybe that's partly what you're illustrating.

C: And this all adds up to one of the things that I feel MacKinnon kept putting his finger on that it is entirely possible that the person whom we would think of as the optimum person, I don't like to use a term like that, the best adjusted or something, but the person we might think of as the optimum person may not be actually the one that is most creative. At least this is part of the message that I've gotten from some of your skepticisms and so on. And this would be, you know, kind of a tough dilemma to face. But it seems to me it gives a possibility that we need to be open.

C: Well, we've often talked about the more creative tends to be adjusting the world rather than adjusting to the world, and we are not in the middle of adjustment when you are adjusting the world in a sense.

C: I wouldn't try to minimize the mystery connected with unconscious activity but I would like to raise a question about the problems of memory storage and the retrieval of information from memory storage is obtained. If we understood all of this wouldn't we also understand the unconscious?

C: Well, these are processes of storing and retrieving. Whether those are all the internal or unconscious processes is part of the question. But where does this organismic knowledge that Dr. Rogers is talking about within this memory storage bank come from?

C: That's a good question. But I don't know the answer to it, except that I feel that my ideas are always very simple ones but I feel that perhaps we don't recognize fully enough that in part we live as very primitive animals, and pick up all kinds of cues at a level which may be, under certain circumstances, available awareness but maybe would never be available to awareness. I don't know and so you make a choice or a decision which if you were really functioning well and functioning freely, probably is based on all kinds of clues that you have no awareness of and perhaps never could be consciously aware of. I don't know. It seems to me a possibility.

C: I may be stretching the term a little but your emphasis on organismic knowledge as a library storehouse suggests that maybe some of our best instructional media are already within the person and the in-put has in a sense already happened It's a case of using that which is already in there.

C: . . . . or designing films that tap that information, release that information some way or the other without the individual necessarily being aware that the film has been so designed to tap these hidden factors.

C: Don't you think such films would have considerable emotional impact. I feel that they are of the type of things that comes nearest to drawing us forth, they are the things that come out of some direct expression of personal experience in art or in poetry or in your music or simply in somebody's feeling for writing which then taps much of that same source in the other person, because neither person is entirely aware of all that he is expressing in the same terms that the first person that sees a great piece of art. I remember even in high school writing a paper that I didn't think Shakespeare knew all the things we found in him and I have come to believe that that's quite true, that he wrote much more widely than he knew, and what we find in it may well be there and wasn't necessarily consciously in his mind at all. And I think the same is true of the artist.

C: Have any of you used Don McNeels' book Hail Stones and Halibut Bones? Well, this is just a little thing which indicates color. I happen to use that system. Somewhere there's also a film by the same name that's pretty good. But I just used the words and I had probably around half the class brought in material the next morning and some of the material was very good. I thought it was better than the original author had done. Well, this is a fresh experience, you see and taps something in some people.

C: Dozens of people in different parts of the world have written, or spoke to me about using that piece of material. I haven't ever used it myself but dozens of people in California and Minnesota have. . . .

C: Well, I hadn't used it until this summer. Just the title of "Hail Stones and Halibut Bones" I think does something to you. I think in materials that if we ask the question what materials make for release, it seems to me that there are some materials that carry quite an impact and you can think of a series of questions or exercises like this I've just performed. I used one. I was just telling about counting the bricks or not counting the bricks but we have brick buildings of several vintages on our campus and so I said to the class, "How many ways are bricks put together on the campus as you walk from here to the Union Building?" How many ways are bricks used in building?" Well, nobody even thought that they were put together differently, you know. The different patterns.

C: I think in terms of media having impact for the purpose of release, I think of things that aren't possible in the real world --like death, murder, the kinds of things that lie behind, I think, some of your stress studies, at maybe subconscious levels, fear of death. That's got something to do with creativity. And media can release these.

S: I was talking about the way in which film and education television can be helpful in providing a rich input. What I want to point out now is that clearly it is not enough to have rich sensory, perceptual, and ideational input, unless something is done with it, something made of it. Even the richest input is of no value unless put to use. The process of making something out of the elements of one's experience is what goes under the name of intelligence. One would, then, expect a creative person to be intelligent, and in our researches, we have generally found them to be so. I have pointed out that it's not surprising that highly creative individuals nominated by the experts came to us without a single feeble-minded person knocking at our door. But I also have pointed out that it is rather interesting to note that when we administered the Terman Concept Mastery Test to our subjects, we found that intelligence so unusual is not significantly correlated with creativity.

In the case of architects the correlation between intelligence as measured by the Terman Concept Mastery Test and creativity was -.08, and in a sample of research scientists working in industry the correlation was -.07. What I would stress is what we earlier noted in the O.S.S. work, namely, that what is more important than the level of intelligence as measured by any test of intelligence, is the effectiveness with which one uses whatever intelligence he has , what in the O.S.S. book we called effective intelligence. And in this connection I would like to report what some of you have already heard me report, namely, that some years ago, in a study of leisure time inventors, I discovered that the inventor in this group who held more patents than anyone else in the sample and indeed more patents than were held by any of our highly creative researches in industry, scored six on the Terman Concept Mastery Test. By way of comparison, mean scores on the Terman are for a sample of creative writers, 156; for research scientists, 118; for architects, 113; and for Air Force Captains, 60.

Now, what I would point out is that the Terman is essentially a test of verbal intelligence, which as many of you know, consists of synonyms, antonyms (essentially a vocabulary test of intelligence), and analogies (a test of word knowledge, general information, and reasoning ability). It is scored number right answers minus number wrong answers. On such a test, one who guesses, when he is not certain of his answer is apt to be penalized and will of course, be penalized if his guess is wrong. If for example we count only the correct responses, which our inventive inventors puts down, he scores 87 rather than 6. In other words, he has a fair amount of correct knowledge which he can record, but also a good deal of false information that he doesn't hesitate to give. I think he's instructive for our deliberations because he reveals in taking an intelligence test, a willingness to take a chance, to try anything that might work, and this attitude also characterizes him in his inventive activity. He is typical of many who make up for what they lack in verbal intellectual giftedness with a high level of energy, a kind of flexibility which enables them to keep coming at a problem with a variety of techniques and from a variety of angles, and being confident of their ultimate success, they persevere until they arrive at a creative solution.

Now the performance of this individual as compared to most of the highly creative subjects whom we have seen suggests to me that in any kind of development of instructional media for the nurturing of creativity, we have to take into account the varying levels of intelligence of the students for whom the materials are prepared. I would think that the media that would be good for the gifted child is not going to be equally good for the culturally deprived, underprivileged child who has not a great richness of experience, or the child who cannot perform effectively on tests of verbal intelligence. Here I am inclined to agree with what Malcolm Provus was saying, that probably our greatest task in attempting to develop instructional media to encourage creativity is to develop media which will be used for those who are not of the highest intelligence. There is a certain sense in which if one has really already learned the techniques of reasoning and thinking, he doesn't need as much instruction as those who have not learned these techniques which are so important for creative thinking and problem solving. I am afraid that a great deal of our work in the nourishing of creativity is aimed at the wrong sample. Since I have been involved in the study of creativity, I have spoken to many administrators and teachers in a number of school systems and find almost invariably that they are seeking to nurture creativity in the intellectually gifted. In other words, those who are chosen for special kinds of instruction are those who do well on intelligence tests and conversely there is a neglect and by-passing of those who do not already perform well academically. I would like to get it written into the record, that it is important to give special attention to this other group compared to those who do not perform so well verbally who do not do well in verbal intelligence tests, and who are not doing so well in school subjects where verbal skills are emphasized and rewarded.

C: May I get a couple of things in hhe record? I reviewed the the Terman Concept Mastery for Buros and certainly in the areas of scientists where it was used on Taylor's work for example, it had about the lowest correlation of all contenders with performance on the job of scientists in research. Other contenders had at least some significant correlations and it hadnot as I recall. It had the lowest of all contenders that he used in his study. What you are saying here in the last point too, is that they have already decided who are the gifted, there is only one kind of gifted and they have already decided who they are and now they have a new kind of training to give them which is of course contrary to the evidence that there are multiple types of giftedness. There is plenty of evidence. The other question I wanted to ask you is what is your relationship between what you call your judged intelligence by your assessments and your tested intelligence. Can we feel for that?

S: Well, it is positive. Usually after an assessment week-end we rate the intelligence of our subjects as we would estimate it from having observed them in a variety of situational tests and procedures. With practically no exception there is a positive correlation between our ratings of intelligence and intelligence as measured by tests. There isn't an inverse relationship between the effectiveness of most persons and the intelligence scores which they earn. But it is far from a perfect relationship and I think if we pick people only on the basis of their intelligence test scores, we will overlook a lot of people who nevertheless show a striking degree of effective intelligence in dealing with life situations and problems.

What I think our inventive inventor also suggests is that the creative person, regardless of the level of his verbal intelligence, is cognitively flexible. He is able, easily, and quickly to change set when one method of attack upon a problem does not work. He is able to think of and to employ a whole succession of other means until he finds one that does. And when he succeeds, he will not rest content for the possibility of more efficient and more elegant solutions to the problem will continue to intrigue and trouble him. He will in short have the capacity to be dissatisfied with his accomplishments without being discouraged by his failure to achieve his goal of perfection. And accordingly he strives unceasingly to solve the ever more difficult problems he repeatedly sets for himself. I think it is this being dissatisfied with what one has done, and the feeling that one hasn't reached one's inner goal, the individualistic, unique, idosyncratic goal of perfection which the highly creative individual has set for himself, which drives the individual contantly on. This having an unique goal as against the goals and judgments and values of the social group is what differentiates our highly creative individuals from our less creative subjects. And this is the source of the tension which drives the creative individual positively in this creative effort.

Educational television programs can, I believe, be designed to picture in a variety of fields and with problems of quite different types, the essential elements of the cognitively, flexible approach to the solution of problems, illustrating the possibility of approaching problems from a variety of angles and with a multiciplicity of techniques. They can effectively illustrate different modes of search and inquiry, leading the student to recognize that the solutions to problems are crucially dependent upon formulating the right hypotheses and thus attaining the right kinds of answers, the necessary answers, to the questions which he poses to himself. Television programs and films seem to me could be admirably suited to demonstate the possibilities of many different solutions to a single problem.

Next, I would report something we have mentioned again and again at this conference and which we all know, namely, that there are individual differences in creativity, some persons being strong in just those aspects of the creative process in which others are weak. For example, some persons can give a large number of original responses, but they will not be very good. Others will give fewer responses but characteristically and uniformly better ones. There tends to be a positive relationship betwen quantity and quality of responses but it is not perfect at all and this means quite clearly that there are individual differences with respect to the creative processes and the kind of creativity that an individual will show. I think the implications of this are clear, namely, that there is no single method for nurturing creativity.

Procedures and programs, I believe, must be tailor made if not for individual students at least for different types of students.

Here we come face to face with one of the major limitations of television in nurturing creative potential. Television programs are produced for mass instruction. Their cost prohibits their being designed for individual students, or probably in most instances for even different types of students. Nor can the material presented in them be speeded up for the rapid learner or slowed down for the slower student. I was impressed by Jack Edling's report about the enormous cost of producing a television program. In the case of film we are somewhat better off for there are certain kinds of film which permit, as Lester Beck reported, the viewer himself to speed up the film,to stop it, or to move it on more rapidly as he may wish. But in general I would think that films would have some limitations with respect to taking account of individual differences just as television programs very definitely have. This means then, that if individual differences are to be taken into account in any program which utilizes film and especially educational television, this can really be done only after the viewing in what the classroom teacher does by way of setting different problems for different students, and in encouraging them to set problems for themselves which are suggested by or rise out of the material seen in the film or telecast. Here I would merely underscore what Lester Beck said. It will have to be remembered constantly that educational television cannot and shbuld not be thought of as freeing the classroom teacher from dealing with individual differences. Just because they are not and I believe cannot be taken adequately into account by the televised program, the classroom teacher must pay more attention to individual differences now than she has in the past, and especially so if creative potential is to be encouraged. As to how this is to be done, I would suggest that to nurture the fullest creativity in those students most fertile with new ideas, greater emphasis should be placed upon seeking the implications, the deeper meanings, the possibilities inherent in every idea they experience. This is a matter of pursuing ideas in depth and with scope, not criticizing and rejecting new ideas which it is so easy to do and which I believe will certainly often be crippling to creativity. Insights, however, fresh and clever they may seem to be, do not become really creative solutions to problems until their consequences are tested in application and revised and extended to meet the requirements of the situation for which they were first devised. In other words, I am stressing again that matter of evaluation and elaboration, that end aspect of what I have described as the creative program.

Another finding in our studies is that creative persons are independent in thought and action and these traits are so characteristic of our mature subjects that is is difficult to believe that they were acquired after the school years. Indeed, according to their own reports, this independence of spirit was already theirs in high school, though tending to increase somewhat as the years went on.

One can well believe that many creative students as well as students with creative potential chafe under the discipline and group activities and requirements of the classroom. It is not that these students are lazy or that their level of aspiration is low or that in their rebellious attitude they are rebels without a cause. The problem is if the teachers let it become a problem, derives from their high level of energy which they seek to channel into independent non-group-coordinated striving for extremely high goals of achievement which they set for themselves and which may well conflict with those goals which are set for the class.

As we have found, it is a fundamental characteristic of creative subjects that they are strongly motivated to achieve in situations in which independence of thought and action are called for and have much less interest in or motivation to achieve in situations which demand conforming behavior, I can only conclude, in spite of the repeated misgivings which I have expressed in this conference, that teachers who are genuinely interested in nurturing creativity must be prepared to grant more autonomy, to their abler students and especially those who show some creative potential, and even to reward them for behaviors which at times may be disturbing of classroom harmony.

For the most part, though, students with true creative potential will not so much actively disrupt classroom activities as they will passively and at times stubbornly and independently resist efforts to integrate them into the group. Not infrequently, it seems to me, students of creative potential, concerned with their own experiences of both the inner life and the outer world, often more introvert than extrovert, and more isolate than social, will pursue projects of their own making.

Here again I would note that educational television programs as we have known them so far, do not seem to be the medium of choice for encouraging that independence of thought and action which is so basic to true creativity. It is unrealistic, of course, to expect any one's educational medium to accomplish everything. We should not forget, however, that television programs that are rich in content and imaginatively conceived and produced, can stir the interests of able students and suggest projects which they can set for themselves and pursue largely on their own. The creative classroom teacher is one who will not feel anxious when he "loses" students in this fashion for he will know that in this way they are really finding themselves and making progress towards the fuller development of whatever creative potential is theirs.

In the relation between teacher and student, we face the paradox and the problem that at just the time when increasing emphasis is being placed on the identification and development of creative talent which demands that the student be given more individual treatment, if not attention; the teacher/student ratio is almost certainly bound to worsen as a result of the explosion in population.

I would suggest that a partial answer lies in the use of automated techniques which have the merit that they permit the student to pace himself. The very personality of the potentially creative student is, I think, almost ideally suited to self-instruction. At this suggestion I can hear howls of protest from many persons that it is just the creative student with his disposition to separateness and aloneness who needs for his own sake and for his healthy development the special personal ministrations of another human being, his teacher, and more association with his peers if he is to develop into a well-rounded person.

To this I can only answer that most of the highly creative persons we have seen have not been especially well-rounded. They have one-sided interests and sharp edges to their personalities and marked peaks and dips in their personality test profiles. One knows these creative individuals when one runs up against them; they have sharp corners, and I would suggest that we will not create our students in the image of the highly creative if we always insist upon their being well-rounded.

Here we come face to face with a sharp conflict of values in our society and in our schools today. The emphasis on the one hand upon togetherness, the integration of the individual into the group and its activities, good group dynamics, and smooth interpersonal relations; and on the other hand, the nurturing of creative talent. All our evidence points to the incompatability of these opposed values and goals.

In this connection, I would point out that there is probably no one set of experiences or no one set of content for instructional media that will nurture the creative talents of all students. And this is because there is more than one way to be creative. Indeed, it seems to me there are different kinds of creative talent, and the experiences that nurture one kind will not, I suspect, nurture the others.

It is really a much more complex situation than I shall now picture it as being but I would suggest that there are at least three kinds of creativity. One of these might be designated *social creativity*. This is the kind of creativity that spontaneity training and T-group experiences are designed to foster. Social creativity or interpersonal creativity makes for good feeling and smooth interpersonal relations and effective group performance. But I am not at all certain that the individual who shows this kind of creativity will be the same individual who shows what I would call *productive creativity*. The individual who in his creative work produces novel products, whether they be things or ideas or scientific theories or what have you, is frequently the kind of person who is not especially interested in interacting closely with others and is indeed quite often very much of a loner whose creativity is only inhibited when he is forced to act as a member of a group. There is still a third kind of creativity which might be called personal creativity and this, it seems to me, is the kind of creativity that Otto Rank described as an individual's making a work of art out of his own life. What I would call personal creativity has also been vividly described by Maslow in his writings about the self actualizing person. Rank's and Maslow's creative person is a person who develops to a marked degree his own unique potentialities. It is conceivable that a person might be in Maslow's terms a self-actualizing individual showing what I would call personal creativity without his being a person who creates anything of value to society outside of himself. If there are indeed different kinds of creativity--I have mentioned only three kinds: social creativity, personal creativity, and productive creativity--I very much believe that we shall have to be much more differentiated in our thinking about the kinds of programs that foster creativity than we have been in the past.

C: Tell me, in terms of this self-actualizing concept, wouldn't it be true that if each individual did achieve his greatest self-actualization that your first type of creativity would also be covered too.

S: I don't think so because you see one could say that the highly creative individuals we have seen have been self-actualizing, but in actualizing themselves they have often done so at some expense and some cost to their wives and families. We were much struck by the very high divorce rate of these creative subjects. I was going to publish this high incidence of divorce finding but I thought I had better check the norms and when I did I discovered that while the rate for our subjects was high it wasn't statistically significantly higher than the national norm. There is no doubt that a great deal of tension and conflict was experienced by some of our most creative subjects. It clearly is not the case that the person who is most self-actualized in being able to produce, to develop, to create new concepts, new ideas, new objects, is necessarily the person who is going to be most effective in personal interaction with others.

C: You mentioned three types of creativity and I agree there is a conflict here, but when you talk about self-actualizing as one type and then you talk about the idea of those that will make the greatest creative contribution, are these two together? I don't see any disparity; I don't think they need this.

C: I think he is talking about self-actualizing in one area of human performance and they have come way up to the top there but in other areas they haven't. They may be quite deficient and lacking in some of the areas that the whole or complete person has.

C: I am getting interested in some of the creative youngsters at the elementary school age. They seem to be able to take or leave the group. That is they don't have to be with the group all the time. And in fact they just go in the house or go wherever they want to if they have projects which to pursue and I have noticed this for years, this being with a group but they can function very well with a group when they are in it, but they do leave it, and they do sort of join it on their own terms. That is they won't always become a member.

C: I have some other comments I would like to make at this point. One is that one indication of what you say is that children in general, I think, should be trained to recognize and tolerate the sharp edges of the individualist. And the other is that in line with your comment that there are different types or more directions of creative performance, there is a class of creative people whose field is interpersonal relations, that is the politicians, and so on, and they shouldn't be forgotten.

S: That's right. I wouldn't suggest that any one of the three types should be forgotten. I think all three types as I described them, are valuable and each should be valued. All I am suggesting is that different kinds of techniques and different kinds of programs and different kinds of experiences are going to be required to nurture the creativity of these types.

C: Just one last question to clear up my mind. Are you saying that a person cannot or may not be able to make these great creative contributions if he is completely self-actualized in Maslow's terms? In terms of his total productivity.

S: No, I wouldn't say that the self-actualizing person will be unable to perform creativity in the sense of producing outstandingly creative products. He might be creative. I just would point out that I think very frequently individuals who show one type of creativity most markedly do not manifest the other kinds of creativity.

C: Well, the point I was trying to make if you had self-actualization in the fullest sense that I think Maslow means, at least the way I would interpret it, then all A would be B. All of your very creative, that is a great creative production, could come of this kind of a personality or from this kind of a person. But then you would also have some people who are only self-actualizing in some small area and they would still make a great creative contribution there but not be what Maslow is talking about.

C: Let me talk back to this. I think there may be something closer to zero correlation. You could find some that were self-actualized across the board, if you want to think of it this way, who might really not attain anything very high in terms of world accomplishments.

You have the possibility for zero correlation. There would be others who would really have focused their energies in other ways. I really think it is kind of a big dream in a way to think that a person is going to develop all of his gifts to the fullest extent, each and every one to the fullest extent, because you are going to have to have some selectivity. There are people who then instead of being completely diffused across the board have selected their areas and put their energies in other directions.

C: Well, this term "self-actualizing" has always been fuzzy to me. How do you know if a person has self-actualized himself?

S: I think Abe Maslow speaks of self-actualizing rather than self-actualized. It is the process that he stresses and the implication is that it is never completed. No one is ever completely and fully self-actualized.

C: Unless I misunderstood you have suggested that actually it might be poor policy to try to round off the edges on some of these people.

S: I am inclined to think so. I think there are social reformers who feel that this would be a very improper position to take but in an ideal world perhaps it wouldn't be this way. But given the reality of human nature as we have seen it so far I am inclined to think that there will almost certainly be conflicts between those most driven to be creatively productive and may in their environment and in society. If we really set as our goal making everybody well rounded and smoothing off all their rough edges this will necessarily involve a lot of the pressure toward conformity which we have seen which tends to stifle creativity. Actually, I think a great deal of the talk of the people around this table has been suggesting that one ought to seek to create environments in which individuals can be true to themselves giving somewhat less regard to the social situation. Of course it is a balance that is desired and one can only go so far in expressing one's own individuality. I am just not convinced that if we develop a social community in which the emphasis is upon inter-personal harmony that this will necessarily be the community in which we are going to have any applicable increase in creative productivity.

C: I think the connotation of this word, self-actualized or whatever you want to call it, is completely different in each of our minds because I don't find anything inconsistant with that term. Now maybe I don't understand it well enough. To me it is kind of a self-actualization within the area in which a person needs to accomplish his self-actualization. Does this make any sense? I mean it doesn't have to mean that everybody has to have every one of his talents developed to the fullest of his ability, but that he channels his energy into the area where he is going to achieve the greatest self-satisfaction or self-realization. Maybe he could have done it in other areas too. Maybe those areas are lying dormant, but he is achieving a great deal of self-realization in this particular area and to me that is the sign of the self-actualized individual.

C: But along with this, some of us may sense that if he is doing something that is extremely unusual and unexpected and not squaring with current day thinking and so on, the sharp edges are going to be an automatic concommitant as he protects himself and forges forward to excel.

C: As you made the transposition there would you think that any of these three kinds which may essentially have a zero correlation suggest some difficulties in media? Would you think of any of these which preceeded the others are off-balance? Is it likely that the type like Rank described is a more basic type developmentally?

S: In Rank this is not the basic type. For him the basic type is the adapted individual, the normal man, the man who conforms to society and who incorporates into himself most fully the dictates of society.

C: Is that a dream too of environment and development?

S: No, I don't think so because you see if you ask youself if one of these types is basic to the others this suggests that one is required for the second to come into being, and the second in turn must provide the third. I don't think it's that way. I think these are three different kinds of being creative.

C: Do we have a prescription type connotation? Would the frequencies differ for different age levels? Actually I should think social contributions don't come from children. Therefore you could find more self-actualization. It seems to me that's the whole position that art education has taken. It's on that first type as special ideas in child art that is making something unique out of one's own logic. This is its main objective, I think, to which many artists do not agree because they are thinking up type three.

C: I think there is another concept that might be helpful here, especially in dealing with children and adolescents, and that's a kind of a basic autonomy. We have talked about this. I mean we talked about people being independent and so on. But it seems to me that very early there are some children who do not adapt in the regular sense. That is, they are quite prone to say, "No, I don't want to go to the show tonight. I want to do something else." Tomorrow night they may go with the gang to the show or something else, but there is a kind of autonomy there; they manage themselves so that they don't have to do this constant conforming. I think as I read some of the memoires and various things written on Einstein how he was considerate in crucial times of his friends and in other times he appears not to have been. So that here you have sharpened edges in the conventional sense but maybe in the deep sense you don't have. I don't know that I know that much about him. But, I know there are many instances where he showed deep consideration, went out of his way to do something for someone when ordinarily he didn't care to do it. But I think this matter of basic autonomy daring to be one's self is a very important kind of thing.

C: What bothers me here is what are the consequences if we begin to teach this type of thing, particularly by new media devices as against the common goals of education that have been around for years for developing a well-rounded, well adjusted, socially acceptable child.

C: Well, maybe we can redefine well-rounded and well-adjusted. Our definition is stereotyped. I see no reason why we can't define this; that is, with someone working in the public schools. It always irritates me when I have a youngster who is sitting at his desk and doesn't want to go outside. I don't think it is necessary to make him go outside at that moment, certainly not until I find out what he is going to do and why he doesn't want to go outside. I think I would like to watch him and see if maybe tomorrow he goes outside. And if you watch him, except a few personalities that are having genuine difficulty, you know, they are being picked on by other children and don't know how to handle it or something like that. Often times if you will just watch a day or two you will find that the next day he is playing very comfortably with someone. But he may not do this every day because he has some of his own autonomy. I think this should be cultivated.

C: I think we need a re-evaluation here. It seems to me quite reasonable that we might have fewer criminals and delinquents and mental break downs if we had less insistance on being well-rounded.

C: In the narrow sense.

C: Yes. I think we cause a problem frequently by insisting on it and I think we cause ineffectiveness. One of the big arguments of the American jet aces in Korea, just as one example, is the insistance of their commanding officers that they go on rest-and-recuperation leave to Tokyo. They said this was the worst thing that they could do, that it threw them off, got them out of condition, and made them more vunerable and less effective as fighters and they refused to go. They then were officially ordered on recuperation leave anyway. Commanders insisted on the well-rounded individual who should go to Tokyo and live it up.

C: I think one beautiful example of a child's perception of this is the story of mine that a fifth grade girl gave of the duck named Glob-glob. The latest duckling society insisted that the duck quack and go chasing and chasing and chasing and the story goes on, and finally Glob-glob dies and the closing word says that he goes where there are no more quackers and chaser. I think that's the way children feel about a lot of our insistance that they be well rounded.

C: Well, one way to sort of shift ground is to shift from adjustment to development. Strategies will develop. I have sort of been working with this problem here in terms of these words, for whatever help it may be, socially actualized, personally actualized, and productively actualized.

Trying to emphasize the actualization process implies utilization of different sources of media. The socially actualized would be using the media of relationships for their creative development with people. Personally actualized would be tending to emphasize their relationships with themselves, with their experiences as privately realized and seeking development primarily on that base. Productively actualized would have their focus of attention normally given to the novel they're writing, the problem they are working on, because it would have a more production-action basis.

C: That's a very good way to put it. Now this is probably a little over simplified but I couldn't help but think of the reports from salesmen who really are quite capable of going out and mingling with people and making a sale. But if you check you find as a group they are not interested in their customers. They are just interested in making a sale but they have the effective social techniques to move other people and make the sale but they have no report and no empathy and no real interest in personal relationship with people.

C: I do think in life its inescapable for the human being to handle all three of these problems. He has all three of them to deal with inescapably. It is how we work the mix to provide children, I mean as far as education is concerned. The need to be able to see that they have all three pumps to handle, so it is important that we be able to see the child as if he had a social medium as if he had a personal development and productive development to achieve, as if he had all three of these arenas and to know that he has them all. He should also know that development means that he moves ahead, that it means there is focus and there is a place which is ahead in his power to gain energy and invite integration. There is no movement except where there is a front and there is no front except where there is a back.

S: I think that is a very good way of formulating what I've been trying to say. I would add this, that, of course, it is conceivable that outstandingly creative persons develop their desire for aloneness and time apart for contemplative thinking as a result of the strong distaste for group participation which they acquired in their early years, in being forced into group activities. If this were indeed the case, we might be depriving able students of much of their motivation for creative work if we were to free them from participation in group activities and to grant them more time for their individual pursuits, including the pursuit of learning. Now, this I must say seems unlikely to me. Consequently, I am inclined to believe that one of the ways to nuture creativity is to de-emphasize group participation with its demand for conformity and to provide maximum opportunity for the able student to work out his own interests.

Lest I seem to be urging too much freedom for the student, let me say that discipline and self-control are also necessary. They must be learned if one is ever to be truly creative, but it is important that they not be overlearned. Furthermore, I believe there is a time and a place for their learning, and having been learned they should be used flexibly, not rigidly or compulsively. Since I am of the opinion that there are times and places for one to learn discipline and acquire the capacity for self-control if one is really at some later time to be creative. I am going to come back to a former point and raise a question as to whether or not the kindergarten and the 4th and 7th grades are perhaps periods where it is valuable and helpful for some of this discipline to be imposed and incorporated, provided one can still feel free to break away from it when the proper time comes and move on to a higher and more creative level of functioning.

C: I think one of the problems there is the degree to which children are overwhelmed by the sudden and multiple demands and of their somehow learning how to handle these. From our first research we know that individuals who have no stress of pressure don't perform very well, but with increasing pressure and demand they do perform. Likewise, there are those children who show the potential but are overwhelmed by these demands and break off and resort to delinquency or just actually break down, become schizophrenic.

C: You know, something occurred to me that is sort of amusing at this moment. I wonder how much kids could learn to do by themselves, practically independent of the environment? It occurred to me when I was in high school that I used to ration my time with the kids because I was very much involved with novel reading. I set for myself the task of reading all the English novels available and I read and read. Now, in order to do this you just have so much time in life and so I set myself a ration on my time with the kids. Now I didn't give it up. We roller skated, we went to the rink and we did different things but I would only go so much and I would have the rest of the time to do my novels. No one told me to do that. In fact I was living with my grandmother and she didn't much fancy my nose in the book. But this was in a sense discipline because I rationed it.

S: Well, you were giving yourself that self-discipline out of intrinsic interest in something which I have referred to and which I think is probably the best way for people to get discipline.

C: Do you have any idea how many youngsters are doing this?

S: No but I'm afraid an insufficient number. I think there are too many cultural and social forces which tend to block this kind of thing.

C: One of the things I think we ought to always do, especially in educational experiments, is to find out how much children learn in defense of themselves. This is the term that was used in an experiment which was quoted in 1934 where learning of second grade arithmetic was studied by the method of discovery as opposed to authoritative identification. The author was puzzled by the fact that under authoritative identification he got lower correlations between IQ and different mental age and achievement than by learning by discovery where he had hypothesized that more of the mind would be involved in learning by discovery.

But he interviewed these kids afterwards, several hundred of them, and he was amazed at how much, as he put it they were learning in defense of themselves, with some children being taught by authority that they were learning by discovery on their own, and children who were being taught by discovery were seeking out authorities in defense of themselves. I think it happens in every educational experiment we conduct and I think maybe we ought to do more of this kind of interviewing or finding out really how much they are doing in defense of themselves.

C: Well, Bruner recorded that there is tremendous difference in the way the youngsters function in the classroom and being examined individually as to the processes that they are using.

C: We find that in boredom experiments too, that this is one of the things that frequently defeats you when you set out to conduct a boredom experiment. Some individuals, particularly old ones, are very skilled at using ways of entertaining themselves when they are bored.

S: I would like now to move on to another point. As you know from earlier reports, we have found creative individuals to be perceptive, more perceptive than judgmental. Another way of putting this is to say that we have found them open to experience both of the outer world and of the inner self. And of course if a person is very open to experience of both kinds, there is some danger that he may be overwhelmed by experience and overloaded with sensory, perceptual, and imaginal input, becoming confused and anxious as a result. We do find that our creative individuals score higher on anxiety measures than their less creative peers but we also observe that they have mechanisms for controlling their anxieties. It does seem that the child who is developing creatively is very apt to experience this anxiety and confusion, and at such times a teacher may be of the greatest help in communicating an emphatic understanding of the turmoil going on in the student and conveying to him a quiet even unspoken confidence that the anxiety which he is experiencing will pass. The other way, the non-creative way, is the rigid control of experience, repressing impulsive and imagery, blinding oneself to great areas of experience and never coming to know one's self.

I am now going to say something which some of you may disagree with, because I have a feeling that some people feel that everyone can grow creatively and that no risks and no dangers are involved in such growth. I think in an ideal utopian society this would be the case but I think in our own society as it is structured today and as it is apt to be structured for still some time to come, to grow creatively is not the easiest way to develop. For some it may be too risky and dangerous an undertaking. Just as insight therapy is too dangerous a technique for a therapist to employ with certain kinds of patients so it seems to me that there are some individuals who perhaps would do well not to seek to develop their fullest creative potential, because of the great richness and conflict and confusion and anxiety which they would experience and which they would be unable to manage effectively. On the other hand those who succeed will reveal a richness and actualization of the self which the judgmental person, who excludes a lot of experience and in the extreme case pre-judges experience and thus becomes the prejudiced person, can never achieve. More than most, creative persons are able to recognize and to give expression to most aspects of inner experience and character. They are able to admit into a consciousness and into behavior much which others would repress. They are able somehow to integrate reason and passion, and to reconcile the rational and irrational. One question which I asked of all our subjects was what their attitude was towards the irrational. It was fascinating to hear the way in which these highly creative individuals answered the question often becoming quite excited in their response. "Oh, the irrational. It's a treasure house of goodies!" It was clear that they welcomed the irrational into their life, yet they were extraordinary effective, reality-oriented persons.

I must point out, however, that young adolescents, young students, obviously will not often show these traits which are so characteristic of the mature person able to achieve these reconciliations of the opposites. It can safely be assumed, moreover, that in our present society many students who will eventually be characterized by these mature traits of the creative, will, as adolescents, be troubled and disturbed, experiencing conflicts of roles, possibly crises in religious beliefs, uncertaintly with respect to a multiplicity of life goals, and so on.

It is in respect to this aspect of creativity--the openness to experience and the necessity of finding integrating reconciling symbols--that the subtlest and wisest skills of the teacher as a counselor are needed. My own thought is that when such counsel can be given inconspicuously or casually in the directing of the student to more and more sourcss of knowlege out of which he can find the answers which he needs--the reading of novels or a variety of similar experiences--that this will be most conducive to the creative development of the student. Such non-directive counsel, let me say, is not suited to all students, but it is, I believe, the type of guidance indicated for the student with creative potential.

In this connection, television programs and films which portray with sensitivity and understanding the biography and especially the early years of well known, highly creative persons can be of the greatest help. My thought is that they would picture the same kinds of conflicts, the same kinds of uncertainties, the same kinds of anxieties which the student of creative potential is experiencing. And they would show him how in the lives of these other persons such problems were overcome or even came to be the source of their creative striving and accomplishments. The recognition by students that their problems and conflicts are not uniquely theirs, but shared with highly effective and creative persons in the arts, sciences, and professions, will encourage students, I think, to experience more fully the opposites of their own nature, and to seek to reconcile them in their lives and in their work.

Having stressed the perceptiveness and openness of students with creative potential and the way I think these traits can be nurtured by educational television and films let me now point out that one of our most impressive findings is the extent to which creative people are intuitive in their perceptions. That is to say, instead of focusing upon what is, they are always alert to the possibilities. In Jung's terms, instead of being sensation types, they are intuitive types. And this means, it seems to me that they perceive unconsciously. In other words, they, more than less creative persons, are responsive to multiciplicity of incidental cues and are responding to them without being able to verbalize what they are, and in this way seeing possibilities and always moving on to that which is not yet but that which can become.

Whether the disposition to sense perception on the other hand, or on one hand, to intuitive perception is constitutionally or tempermentally determined I cannot say with certainty. I am inclined to think it is, in part, so determined but I also believe that one's style of perception, one's preference for sense perception or intuitive perception can be learned and can be trained, can be nurtured and can be developed. If we are trying to nurture creativity, there are some things we should not do because they are the things that will reinforce sense perception. We should not emphasize rote learning. We should not emphasize learning facts for their own sake. We should not emphasize the repeated drill of material. And we should avoid emphasizing facts unrelated to other facts. On the other hand, are there things we can do to nurture intuitive perception? I think there are many things we can do using instructional media that would be highly effective. We could place emphasis upon the transfer of training from one subject to another. All too often we teach subject matter in the compartmentalized cells and do not stress the generality, the relationships, the similarities of one to the other. We could emphasize the common principles in terms of which facts from quite different domains of knowledge can be related. We could encourage awareness of analogies and similies and metaphores. In psychological science in an earlier day, psychologists were trying so hard to be scientific they thought that any analogical thinking was primitive and unscientific. In this way, it seems to me, they put dampers on their creativeness. I think what we have to do is to acquaint students with the tremendous openness to experiences which comes through the growing facility with analogies and similes and metaphores.

C: Eyring, the president of the American Association for the Advancement of Science says his thinking is analogous.

S: Physical scientists have been much more willing to admit that analogy is helpful to them, as indeed it is. We psychologists should do the same. Another thing we might do is to help students to seek the symbolic equivalents of experience in the widest number of sensory and imaginal modalities. I think we ought to spend time with our students in exercises in imaginative play, helping train our students in retreating from the facts in order to see them in larger perspective and in relation to more aspects of the larger contexts thus achieved. I am sure you can think of still other ways in which we could nurture intuitive perception and intuitive thinking.

In my judgment there are few media of instruction better suited to provide the emphases I have been describing than films and television. The flexibility of the camera in bringing disparate objects and images into new relationships, in moving quickly from surface to that which lies beneath, in picturing in concrete images relationships which can thus be more readily grasped and generalized in abstract terms makes it possible to create for the student experiences which will strengthen whatever disposition he may already have to intuitive perception and thinking.

If the widest possible relationships among facts are to be established, if what Bruner (1960) has called the structure of knowledge is to be grasped, it is necessary that the student have a large body of facts which he has learned as well as a large array of reasoning skills which he has mastered. You will see, then, that what I am proposing is not that in teaching we should neglect acute and accurate sense-perception, but that we should use that to build upon, leading the student always to an intuitive understanding of that which he experiences.

Another finding which I want to report is that on the Allport Vernon Lindzey Study of Values our highly creative individuals earn their highest scores on the theoretical and the aesthetic values. I am not going to say anything about the theoretical value, but I would like to stress the aesthetic value. Allport and Vernon, you may recall, believe that there is probably some conflict between the theoretical value with its cognitive and rational concern with truth, and the aesthetic value with its emotional and affective concern with form and beauty. But as I have indicated these are the strongest values in our creative subjects. That they are both emphasized suggests to me that for the truly creativeperson the solution of a problem is not sufficient. There is a further demand that it be, to use the mathematician's term, elegant.

S: The aesthetic view point permeates all of the work of a creative person, and it should find expression in the teaching of all subjects if creativity is to be nurtured in school. Aesthetic values are obviously stressed in art, in music, and perhaps to a lesser degree in what is now called the language arts. It is no less important that aesthetic values be recognized and emphasized in all fields.

Here I would note that film and television offer especially appropriate means for the representation of the aesthetic aspects of all fields of knowledge. The aesthetic, the truly aesthetic, is often expensive to produce and cannot be provided in every classroom to the extent that would be ideal. Beauty once created either in its own right or in the display of objects and in the representation of the structure of knowledge can be photographed on film or by video tape and thus made available for thousands and thousands of children on television and motion picture screens. Excellence and elegance in all fields of knowledge can, via the medium of television and film, be experienced by numbers of students to a degree undreamed of only a few years before. I think here the film maker has a wonderful and very exciting opportunity.

I'll next point out that in life histories we repeatedly find our creative subjects testifying to the single importance of some one teacher during their high school or college years. A teacher who really shaped their professional identities got them absorbed and excited in a particular subject, and played a most important role in nurturing their creative potential. This teacher, by his or her devotion to a field of study, exhibiting the excitement and satisfaction that comes from a deep absorption in its problems and challenges, stirring the imagination of the student by a clear exposition of the structure of knowledge in the subject, and seeking to respond creatively to its still unsolved problems, offers the student a model with which he can identify. Most often it is not the profession of teaching with which the identification is made, but the field of study which is taught with so much skill and devotion and excitement of the professional field to which it may later lead, e.g, medicine, law, and a host of others.

What I am suggesting is that from observation of this kind of teacher, a student learns something of the delight and joy and fresh insights that come from confidence in one's competence and in the exercising of one's skill, and is motivated to acquire through study and hard work and self-discipline the knowledge, skills, and competence which alone provides grounds for a confident setting for one's self or ever more difficult problems in the field of one's interest.

The master teacher on television should be a supreme example of the effective and devoted teacher. But whether in the absence of the personal give and take between the students and the teacher in the classroom or laboratory, the television teacher, seen only on the screen, can be as effective as the object of the students' identification, only time and research can demonstrate. If I were to hazard a guess I would think that in this aspect of the teaching-learning process both classroom and television teacher can be effective, but the role of the classroom teacher as a person, as teacher, and as an example of his or her own field of knowledge, will always be of crucial importance. And thus I come back again to thepoint that however many instructional media we have, we do not get rid of the classroom teacher, the classroom teacher is there and there she will remain of the utmost importance.

In my remarks so far I have suggested the implications of some of our findings primarily for television and film. But you will have noted throughout my discussion that in so far as I see television as having possibilities for nurturing creative potential it also in so far as it stirs something in the student so that the student seeks to learn something by and for himself. In so far as a student is passive in looking at film and to the extent is not led by it to self-generated striving and active response film is not going to be very effective. One might well believe that among the hosts of instructional media those which will be most helpful are those which will engage the student in actually doing those things which he is going to do later in his creative thinking and problem solving. And so automated instructional programs, I think, hold perhaps even greater promise for the nurturing of creative potential than film and television.

In this connection, I want to report just very briefly on the work which Richard S. Crutchfield at the Institute of Personality Assessment and Research has been doing in the attempt to facilitate creative thinking in problem solving in fifth and sixth grade children by means of an auto-instructional training program. He had three matched pairs of classes, one class of each pair being given the training, the other serving as a control. There isn't time to go into the details of the study., so I shall merely report in the authors' own words the general format that was employed.

The auto-instructional training program consisted of a series of lessons containing simplified detective stories. The detective stories were chosen because they interest children and because they effectively combine many of the essentials of the problem solving concept. In as much as the aim was to train for a generalized problem solving skill, the problems did not pertain to specific curricular content but dealt rather with a variety of mysteries and puzzling occurrances such as the theft of a statue from a museum and the case of strange goings-on in a deserted house.

Each lesson posed a single mystery problem which the child was to solve. The lesson was constructed so that each child, by being given successively more clues and information was finally lead to discover the solution for himself. At various points in the story the child was required, at first, to restate the problem in his own words, secondly, to formulate his own questions, and third, to generate ideas to explain the mystery. Immediate feed-back was given to his responses in the form of examples of other ideas or questions which he might have thought of in the given situation. These examples were primarily ones which fifth graders would find novel and uncommon and which would open new lines of investigation or new ways for viewing the problem. It was assumed that presenting numerous examples of this type, would tend to broaden the child's limits of acceptance as to what constitutes important questions and fruitful ideas.

"A story line was maintained throughout the series of lessons by developing a narrative concerning two school children, namedJim and Lila, (brother and sister), as they learn to become detectives by taking lessons from their uncle, who is both the junior high school science teacher and a detective in his spare time. The novel and uncommon responses given as feed-back to the children were represented as Jim's and Lila's ideas. Thus, the children could work on the problem in concert with Jim and Lila--first the student generating his own questions or ideas, then Jim and Lila responding with theirs. These stories were presented primarily by cartoon illustrations. It was assumed that such visual presentation would not only increase the student's interest in the material, but would make it easier for him to follow the dialogue and thought sequences of the story characters. Moreover, the stories contained many clues and details, such as maps, that could be presented visually.

"Altogether the training program consisted of 13 lessons with an average of 30 pages per lesson. Each lesson was wholly self-administered and self-paced. The program was of the linear type with both multiple choice and constructed responses included. The total class time alotted for the program was about ten hours divided into 13 daily sessions of 45 minutes each.

"To summarize then, the training program was designed to do several things. First, to emphasize and demonstrate the value and necessity of properly defining the problem, asking relevant questions, looking carefully at details and observing discrepancies, generating many ideas, and being sensitive to all sorts of cues and clues. Second, to give the student repeated opportunity to generate his own ideas and become familiar and comfortable with his thought processes in solving problems. Third, to provide the student with immediate and frequent feedback in the form of examples of valuable questions and fruitful ideas which could serve either as confirmation or as further stimulation to his own thoughts. Finally, to allow the student to participate in the solution of problems with a pair of curious and imaginative children, one male and one female, who act as models to be emulated. The models are not meant to be perfect; they make mistakes, but they learn by them, and progress from initially being poor problem-solvers to being greatly improved ones. It was hoped that identification with such realistic models would induce in the student a sense of his own progressive improvement in thinking skills as he worked through the program.

"In the five days immediately following the end of the three-week training period, all the children were administered a five-hour battery of criterion tests of problem solving, together with several creative thinking tasks and a report of an attitude questionnaire which was given previously."

One of the criterion problems which the children were asked to solve after this training was the following one taken from some of Duncher's work, which I am sure some of you already know. "There is a harmful tumor deep inside a person's body, completely surrounded by good tissue. The doctor can kill the tissue by sending a narrow beam of X-rays through the body to hit the tumor. However, when the X-rays are strong enough to kill the tumor, they are also strong enough to kill the good tissue. If the X-rays are made weaker they do not harm the good tissue, but neither will they destroy the tumor. Your problem is to work out some ways to use the X-rays so that they could kill the tumor without harming the good tissues.

"I am sure you all know the answer to this. Well, anyway, this and similar kinds of problems were given to the child in the post test and five days following the training the experimental children showed a three to one advantage over the controlled in solving problems of the type I just described to you. Crutchfield was concerned that this might be an immediate effect, not long lasting, and so five months later after the children had entered the sixth grade in the fall, he went back and gave them similar problems of the same kind and found that the effect was continuing. The experimental students who had had this program showed a two to one advantage over the controlled students with regard to both the number of ideas generated and the rated originality of the ideas." This is merely one example of the kind of program which doesn't seek to deal with concrete curriculum material in order to create better skills within that, but seeks to develop training in problem solving skills and in creative thinking which are generalizable and permit the child to deal with quite different kinds of materials in a variety of curricular subjects.

C: Did he transfer his experiments to see if it does transfer to school content material?

S: No, he hasn't done that yet.

C: I think the scores or the advantage on the tests of creative thinking held up for five months.

6

Chapter 8

Use of Films and Television for Creative Teaching

Lester F. Beck
Research Professor
Teaching Research Division
Oregon State System of Higher Education

S: The objective of this conference is to investigate ways and means that media are being used or can be used to stimulate and foster the development of creative behavior, especially in children.

The term "media" is understood to include all the aids to learning which are mentioned in Title VII of the National Defense Education Act, such as printed materials (books and programmed units of instruction), graphic aids, audio tapes, still pictures, slides and filmstrips, motion pictures and television. In preceding papers by Provus and by Torrance we were introduced to ways that still pictures, illustrated booklets, new kinds of textbooks, and audio tapes are being used to nurture creative teaching and learning. I should like to extend our consideration of the media to the world of film and television. To help focus our discussion, I have assembled eight excerpts from current films and videotapes which contain features of importance for creative teaching. I don't mean to imply that the excerpts are necessarily the best that could be found. They just happen to be ones that were readily available from my own library of media materials.

In line with Calvin Taylor's introductory paper and J. P. Guilford's models for problem solving, we should look at the film and TV clips from two points of view: content and process. By "content," I mean the information they convey, while "process" refers to the involvement and motivation of the learner, the learning climate which is induced, and the cognitive processes that one called into play. Does the film or TV program keep issues open to induce reflective thinking and problem solving, or is the structure such that an attitude of finality is induced, that there is nothing more to be said on the subject?

The first excerpt is from a film that I acquired from the Institut für Film und Bild in Munich, Germany. This Institute is a state supported activity which produces all the classroom films and related teaching aids for the schools of Western Germany. The Institute keeps in touch with scientific expeditions throughout the world as a source of motion picture footage that might be edited into useful films for the classroom or for educational television.

The excerpt which you will see is from the film, "Auf den Spüren Darwins" or "On Darwin's Trail." When Darwin visited the Galapagos Islands as a young man of 23, he observed that the 13 species of finches found there formed a singular group, related to each other in the structure of their beaks, their short tails, the form of their bodies, and plumage. In Darwin's own words, "the most curious fact is the perfect gradation in the size of the beaks in the different species. . . Seeing this gradation and diversity of structure in one small, intimately related group of birds, one might really fancy that from an original paucity of birds in the archipelago, one species had been taken and modified for different ends." One species, taken and modified for different ends! This is the key concept, one that we take for granted today. But in Darwin's time the entrenched view was that species are unchanging immutable. Darwin worried about the public fury which his published conclusions would arouse, and some say that it was his anxiety, more than any physical ailment that put him to bed for 20 years and delayed publication of "The Origin of Species."

So let's look at the film clip that runs about 4 minutes, remembering that the original film is much longer and shows the general terrain, vegetation, and more about the daily life of the finches as well as some flightless cormorants.

(FILM SHOWN: Glimpses of ground feeding finches, cactus feeders, and tree feeders, all related. Among the tree feeders is the woodpecker finch that breaks off a cactus spine and uses it as a tool to probe for grubs in decaying branches and logs).

Darwin collected specimens of the woodpecker finch but apparently he did not see this remarkable little tree finch in action as it searches for food. Ethologists like Konrad Lorenz at the Max Planck Institute in Germany are pretty sure that if Darwin were to return to the Galápagos Islands today, he would not be especially interested in morphology, but instead would be captivated by the tool-using behavior of the finch, which, with the cactus spine, converts itself into a woodpecker. Since there are no woodpeckers in the islands, the tool permits the finch to fill an empty ecological niche.

The whole business of how this species of finch ever came to use a tool, how this behavior develops and the role that learning plays is still pretty much a mystery which behavioral scientists are trying to unravel. So with this film, a junior high or high school pupil can be brought right to the forefront of current scientific endeavor: The film imparts and feeling of immediacy and participation in the concerns of the scientific community.

C: I was wondering how much film you sorted through to find the example?

S: Very few classroom films, released by commercial producers in the United States attempt to pose problems of the unknown or to explore the forefront of knowledge. But, as I say, more of this "creative" footage probably can be uncovered if we search for it. Without too much difficulty we probably could put together a dozen or so films with unusual content that would arouse speculation, hypothesizing, and creative thinking among students.

C: Here's some footage that you don't run across every day. It isn't like going to a film library and pulling it off the shelf. You have to look for it, even go to Germany to find it. And then it needs interpretation, a setting, like Les has given it.

C: I think this is the role of the teacher in the classroom to be the organizer more than the feeder.

C: To take off on what occurred to me. First is, you have taken a film which shows life taking shape, creation on the way, the natural phenomenon. This is the life phenomenon. The content is right on the ball. The second thing is you've introduced it as a part of the life of Darwin, part of the life of a man who helped form science, to understand nature. The third thing is it gives a chance for students to identify with the person who undertakes scientific inquiry, to understand the formings of creation. The fourth thing is you moved the mystery up to now. I mean you took the detective story and showed it up to the present moment and you leave an open-ended thing such that the contemporary child, seeing himself as the Darwinian mind, continues in that vein so you give him the place of honor, as it were. He can realize himself in the position, persuing an intriguing effort to try to understand life taking shape.

S: You should be presenting this.

C: On this very point I would like to ask those who have worked with actual pupils. How would you use this film? Would it be better from the standpoint of creative teaching to show it first to students without an introduction or mental set, or should the showing be in a structured context such as Les gave us? Which way would stimulate more creative behavior on the part of children?

C: I can think of a dozen ways to introduce this film. Without some kind of introduction, however, the pupil response would be varied and a product of the most recent mental set of the particular group. I think this is a good example of a piece of material that has such a diversity of potential uses for evoking creative behavior that it could be put in almost any part of the curriculum.

C: I think selecting footage of this kind raises an interesting question. This is primarily a matter of perception. You can look at 150,000 feet of film, but the possibilities to be seen in such footage rests squarely on the ability of the guy doing the viewing. He must know his subject matter and he must also be interested in creativity and the teaching of it.

C: But let's go back to Torrance's idea that if you don't create a proper mental set to view this film or to extract what implications it has for creative teaching and thinking, the viewer (pupil) will fall back on his most recent mental set. I don't know how much you've thought about the learner variables involved in this, but we're only at the beginning. I think we need the help of research, if we are to build media that will evoke with creativity the kinds of creative behavior we are trying to get students to perform.

C: Believe it or not, in one of my college classes when I asked for suggestions about the exciting things to do, one student came up with the idea of a film retracing Darwin's steps. I was struck with the originality of the idea. We played with the idea in class, read parts of the "Voyage," and dreamed up a lot of other things that might be done as well. So I am delighted with the film excerpt. I was so thrilled with the idea of our being, you know, original.

S: The content of this film is fascinating to be sure. But in the German narration no questions are asked, no suggestions offered that might lead the children to speculate or to go beyond the visual facts. In other words, the narration is not up to the visual content.

C: It's such a natural.

C: As I have thought about the film, I recalled some R & D films the Army has produced on what we're now doing in research, films that take us to the fringe of knowledge. In schools, very little time is spent on teaching about what is not known.

S: We probably should be paying more attention in our film making to the paradoxes, the uncertainties, and the outer reaches of knowledge, if we are to nurture creative thinking.

The next two film excerpts are related. The first portrays the kind of visual material that can be prepared to involve little children deeply. The second shows some follow-up classroom activities (reading, art, music, story telling) that the film helped to motivate.

The film in question is "Squeah, the Squirrel," produced for primary grade pupils as a demonstration of animal intelligence. The picture shows how a golden-mantled ground squirrel learns to pull strings to get food (peanuts) out of reach. In a terminal sequence, the squirrel carefully pulls a box into position so that it can be used as a stool to reach a peanut overhead. Children seem to identify closely with the problem-solving of the squirrel. They talk to the film and applaud the squirrel for his achievements. They also are eager to see the film again and again.

(FILM SHOWN)

This related excerptillustrates how a second-grade teacher used the film to stimulate creative work among her pupils. Notice the original clay models, the variety of paintings with some showing experiments in progress, and the general excellence of the stories written by the children. Remember, the majority of the pupils are from poor families, and might be classified as disadvantaged. Yet, the quality and variety of their work is exceptional. You will notice that none of the written stories contains spelling errors. This is due in part to each child's using a self-made card dictionary to which he refers if he has doubts about the spelling or correcting of a word.

This excerpt also illustrates how a simple demonstration motion picture can be produced quite inexpensively from still pictures, booklets, art work, and pre-recorded sound.

(FILM SHOWN)

One child in the film was the son of a Japanese gardner. He and a friend became interested in raising peanuts for squirrels. They decided to get some seed peanuts to plant in the school garden. The job was not easy. Peanuts are roasted. Peanuts are salted. There are all kinds of peanuts in bags and cans that won't germinate. The children became involved in a horticultural problem of considerable magnitude. Finally, they located some raw peanuts, planted them, and enjoyed a considerable harvest. Again, we see how properly designed film material can interest, involve, and motivate, producing explaratory behavior far beyond the limits of the film itself. We have too few films that generate what Bloom calls "peak" experiences. Most educational films are routine expositions of fact with little or no excitement potential.

Now let's examine a portion of a film for high school students, entitled Electrochemical Cells. This picture is one in a series of twenty-four produced for the CHEM Study Project of the University of California. It is an example of a beautifully produced film, combining live action and animation. The section we'll see uses time-lapse photography and animation to illustrate the chemical changes that occur at the anode and cathode as a battery discharges. Notice that the narration encourages the student to think ahead, to make deductions about what is occurring, and that active thinking is further encouraged by question marks that dissolve on and off the screen at appropriate points.

All the films in the CHEM Study series are designed for group viewing. I see no reason, however, why they could not be adapted for individual viewing and placed in the library to promote independent study. What I have in mind is the sort of thing that Dr. S. N. Postlethwait is doing at Purdue with his unique auto-instructional and "systems" approach to the teaching of botany. He has established a self-contained learning laboratory, open from 8 to 5 daily, where students teach themselves through audio tapes, film clips, live specimens, and graphic materials. The 800 botany students program their work in the lab at their own convenience. Once per week the students come together as a group, not to be formally lectured to, but to hear outstanding botanists describe collecting expeditions to South America or Tibet, to learn about the role of botany in man's affairs, and so on. The lectures are used primarily for broadening the vision of the student and for motivation. Who is a botanist, anyway, and what does he look like? What sense of values does he have? And what would it be like to live and work in a community of botanists? Are botanists for the birds or the flowers?

Well, what I'm saying is that the CHEM Study films, though well produced, call for a rather traditional method of teaching. They accompany a text and lab manual. The materials are well integrated, but the student must still rely heavily on the instructor and formal class sessions for his progress through the course.

(FILM SHOWN)

C: Even though this excerpt is a part of a longer film it would be easy to put a little clip in these, stop the film, and go to work on the experiment. I mean it wouldn't take much to adapt these films for individual use.

S: That's right.

C: They didn't have all the insights to begin with.

S: There is a movement underway now to make so-called "trunk" films that give an overview of an area plus short, subsidiary or satellite films three or four minutes long. The satellite films are single concept pictures that go more deeply into a subject than is possible in the trunk film. The satellite pictures might also contain more unique or controversial material and might be studied independently as a student wishes.

C: The thing I sense here is that in the first film it was a matter of pure observation. The "party line" did not intrude since the sound track was in German. That is, the description of what science now knows and thinks is more important for creativity than to get established answers in conventional thinking.

S: That's a good point.

C: I have a hunch that budding scientists prefer more information about the stuff rather than answers about the stuff. I'll bet the better scientists, potential scientists, would be the ones who would go through the theory to return later to do their own thinking through the stuff.

C: I'd like to comment on the remarks about the famous botanists and the course at Purdue. Elizabeth Drews has been making some biographical films of famous people which I understand she is using in counseling training but which might have value for creativity training.

C: I think the films are intended for stimulating the gifted.

C: It wasn't counseling so much as film material for use in junior high school guidance. A lot of states, you know, have a required half year of vocational guidance. The film material is intended to show the lives of creative people today.

S: Since the noon hour is approaching, perhaps we should hurry through the balance of the film excerpts.

This next excerpt, taken from the film, Early Marriage, uses a questioning technique, somewhat like Electrochemical Cells except that all the questions are bunched at the end. In other words the class viewing the film is left with several unanswered questions as the film runs out. It has been found that this technique literally forces active discussion of the film after it has been seen with the discussion leading off in all directions.

(FILM SHOWN)

The next excerpts are from the demonstration film, College Teaching with Television: An Inter-Institutional Approach. Among other things, this film shows how eleven colleges in Texas have joined together by means of a microwave network, making it possible for professors on the various campuses, either as teams or individuals, to offer identical courses throughout the system. Some of the colleges are large, like the University of Texas. Some are small, like Trinity. Some are public, some private; some denominational, some non-denominational, and one is predominantly Negro. Also, one is Lyndon Johnson's alma mater. In addition to assuring uniformity of excellence in classroom teaching throughout the system, I was impressed by the fact that the television professor helps to establish an active climate for learning. Whereas the local instructor supervising the class might be inhibited and colorless; the television teacher often injects a lot of spirit and humor into the class sessions. Often, too, the TV teacher leads the class into by-roads that might never occur to an overworked or less experienced local instructor.

(FILM SHOWN -- student response to TV teaching of German and Psychology)

Well, there are some samples. Students throughout the system appreciate the fact that the TV class is clearly college level, and that all students including those at the poorer schools, receive equally good instruction.

C: Do these students ever have a chance to meet the TV instructors personally?

S: Not as a rule. But the local instructors and discussion leaders do. And this is a critical point in the success of any joint or cooperative TV course. Everyone identified with a TV course must feel that his role is important and recognized.

~~C: Excuse me Dr. Taylor. Do you know what time they do not serve lunch here?~~

IMAGINATION: DEVELOPED AND DISCIPLINED

Sidney J. Parnes, Director
Creative Education
State University of New York at Buffalo

S: My thinking is so stimulated by the ideas of others at a conference like this, that I am never able to go on with what I had originally planned to present. Hence, I will begin by making general comments and observations that are a result of the proceedings up to this point.

I would like to comment about a conception I hold of educational conferences that try to change our system of education. Sometimes I feel that education needs a complete shaking-up and restructuring such as will never happen at a conference like this. The kind of restructuring I have in mind causes a great deal of dislocation and other difficulties. To illustrate my point, I offer the analogy of a person who is living in cramped quarters, and who decides that he wants to build a finer house. He then goes through a great deal of hardship and discomfort in order to build this new house while he continues to live in the old one. Instead of taking care of little details and repairs at his old quarters, to make it more liveable, he devotes his time to building the new structure. But when the ordeal is over, he has the new house, with the entirely new way of living it allows. Analogously, in education, I think we may be at the point where we must suffer the temporary hardships of a complete reshuffling in order to reach some of the bright plateaus that I would like to see for the future.

For the moment, however, I am tending to consider myself as a kind of educational engineer. I can hold a blueprint of tomorrow in my mind while living with the challenge of adapting and modifying yesterday's designs. The dynamic feedback of one to the other convinces me that there are only phases between theory and practice--never actual separations.

As educators, we are all in the same boat. It's as though we were automotive engineers driving our 1964 cars while dreaming of the kind of transportation device we would like to create. We could work intensively on our "dream car" or we would do something to make the 1965 automobile a better one. As I see it, the latter is what we can hope to accomplish here. I don't have expectations of a major educational revolution resulting from this conference. My expectations are much more modest. I am looking for minor improvements here and there that might have their bit of impact toward the solution of the total educational problem. I am looking today for ideas that we can use for the millions of youths who are presently in our classes, even though we know that there are many more drastic improvements needed. The latter are not likely to be implemented in time for today's students.

Is there anybody who cares to react to what I have said? How do you feel? What are your expectations?

C: Well, I think one of the wishes of the U. S. Office of Education was that they wanted some questions that might be made researchable. That is part of the Title 7 Program, and they're interested in conducting research in educational media. As such they would like to explore the potential of media in this area of teaching people to be creative, and so if we could ask some questions that are researchable or that would lead to research, research proposals, this would be one of the hoped for outcomes.

S: Well, we can ask very broad, sweeping questions, or we can ask the kinds of questions that might lead us to small improvements, but ones that would be more likely to result in some action sooner. This is the sort of enigma in which I find myself. I'm thinking of the millions of children that are in schools today, who are going to be there for quite a few years while we are working on some of these broad research questions. I'm asking myself how much of our efforts should be directed toward long-range projects as against how much should be in the direction of finding ways of implementing new ideas we already have--ones that already work to a limited extent.

These new ideas are often suspect, just as are all new ideas. Critics ask, "How much proof do you have that your new method is the *best* method?" And my answer is, of course, "how much proof is there that what we have *now* is the best method?" The existing -- what is in effect right now--is often accepted without question. So I say that if we have reasonable indications that we have improvements to offer, we have a right to try them without being asked to prove that these are the very "best" methods. (Of course, they cannot be the *best*, because there is *always* a better way. The best way of doing anything will always remain to be done.)

C: One other way of putting it, either asking our questions of what we're going to do or ask the questions in terms of what is the next step. Ask questions that require an about face.

S: Yes. We can take some next steps forward. Let's go back to the automobile example. I can find a way to make the brakes more effective, or I can look for ways to replace the automobile with some better kind of transportation. I think there should be some effort in both directions.

C: But you can also modify the car drastically, such as putting the engine in the front and going to three wheels and maybe even going to jet propulsion instead of an internal combustion engine.

C: There's another point on that and that is I think this is what partly was Sid's concern about, you can do all these things to the car that you're talking about but to what end? Just for changes sake itself? If we're going to put three wheels on or put the engine in the rear we are going to have the same kind of transportation. If we're not going to change anything fundamentally, why bother. And I think this is the reason that people ask for some sort of evidence, some sort of indication that what you're doing makes sense to somebody, has some advantage. Otherwise, it's enough just to keep going let alone invent change for change's sake.

C: Now I think it's important to be able to see the little things you do as samples of the big things to be done so that there's a sequence from the little things, in a growing fashion, to the big things. So you face the conception of the big thing realized to identify the value of the little thing now to be done. Then there's sequence to the growth. I think the automobile is the image not of a growing thing but of a mechanical thing. And so in our efforts to grow, behavior in society, and a growth image, is one which suggests that little leaves come out and then branches come. But if the leaves aren't part of the system, they don't become branches.

S: I threw a wild idea into the hopper before recess. I said, "Let the kids run the school for a day." Then I became nervous about the idea and added, "at the high school or senior high school level." Viewing the schools as some of them are today, their best idea might be to close down for the day! But if you got them to realize that they might change the system, then maybe they might prefer to be there!

C: Well, this has been done and done very productively in a lot of isolated instances. I know of one teacher, in the fourth grade and this has been written up, where the kids were fussing about the rules of grammar.

They didn't like these so they abandon the grammar books and they wrote their own grammar book. And for any law they had to find I think, 10 examples that validated it. And one by one they constructed these and they wrote their own grammar book, they wrote their own novels, and so forth. So the whole thing grew up out of that. They learned to spell better and to write better and handle grammar better than when they had a book.

S: Another comment that particularly stimulated my thinking in the last 24 hours was that of Carl Rogers, when he referred to society adapting fast enough to technological change. We will have to learn to live in a loose, dynamic way instead of a static way. The discoveries and innovations of the next 20 years will probably make the previous 100 years seem to have progressed at a snail's pace. Therefore, a person cannot foresee exactly what knowledge he will need five or ten years from now to meet his life's problems. He can, however, develop attitudes and abilities that will help him to meet any problem creatively in the future.

A dramatic pointing-up of our dynamic society is the recent piece from Kiplinger's Changing Times. It is entitled "Tomorrow is Here!"[1]

"You walk into the Smithsonian Institution in Washington and you regard with awe the assorted mementos of the nation's past. There stand Lindbergh's Spirit of St. Louis and the original Star-Spangled Banner and Whitney's cotton gin and the Wright Brothers' airplane and the desk at which Thomas Jefferson penned the Declaration of Independence. And then, suddenly, you are aware that the past doesn't have to be 50 or 100 or 200 years ago. It can be only yesterday.

---

[1] July, 1964, page 7.

"For amid the true antiquities are two other relics whose imprints on history are still fresh.

"One is the first UNIVAC computer to be used commercially. Now it's a museum piece. It is a mere 14 years old.

"The other is *Friendship 7*, Col. John Glenn's Mercury capsule. Forevermore, it will be an historic symbol commemorating the plunge of the nation into the space age. It is two and a half years old.

"For a decade and more, the future has been talked about and written about and dreamed about, but now future can be seen in a museum. Space travel? That surely is a part of tomorrow. But man has already traveled in space. Machines that do man's brain work for him? They, too, have been tomorrow's promise. But they are here--now."

This certainly highlights the urgency for developing in people the ability to live in a dynamic society with constant change. We must all learn to expect change,--and to adjust our environment as well as to adjust *to* the environment.

I heard of a medical professor who understands and appreciates the situation we are in. He tells his students at the conclusion of each course, "Within five years, about one half of what I have told you will either be untrue or not worth a darn. This doesn't really bother me; but what *does* irritate is that I can't even tell you which half is which."

Until recent years, there was widespread doubt as to whether the creative behavior required in our dynamic society could actually be developed through education. Now, however, there is increasing research evidence that appropriate educational methods can encourage such behavior.

Creative behavior is defined for my purposes, as behavior which demonstrates both uniqueness and value in its product. The product may be unique and valuable to a group or organization, to society as a whole, or merely to the individual himself. Thus, in behavioristic terms, creative behavior is: (1) a response, responses, or pattern of responses which operate upon (2) internal and/or external discriminative stimuli usually called things, words, symbols, etc. and (3) result in at least one unique combination that reinforces the response or pattern of responses. In general, such creative behavior may be classified as discriminative, relational, and evaluative.

Creativity is thus a function of knowledge (experience), imagination, and evaluation. Bruner (1962) describes learning as encompassing "acquisition, transformation, and evaluation." He is referring to creative learning,--not learning in the usual sense of the word. Conant (1963) emphasizes the need for better knowledge on the part of teachers, more acquisition. Without knowledge or experience, there can obviously be no creativity. But, as Whitehead (1929) emphasized long ago, education should aim at "the effective utilization of knowledge." Conant argues particularly for the tools; Bruner and Whitehead emphasize all three elements involved in learning.

By way of analogy, we might consider the teleidoscope, wherein the more pieces we have in the drum, the more possible patterns we can produce. Likewise, in creative learning, the greater our knowledge or experience, the more patterns, in combinations, or ideas we can achieve. However, as in the kaleidoscope, merely having the knowledge, the bits and pieces, does not guarantee the formation of new patterns. In the kaleidoscope it requires the revolving of the drum; in the mind it requires the manipulating or relating of knowledge, the combining and rearranging of facts into new patterns in the form of ideas.

The effectiveness of creative productivity also depends, of course, on the evaluation and development of the embryonic ideas into usable ideas.

Without knowledge or experience, imagination cannot be creatively productive. With abundant knowledge, but without interrelating it, we again achieve no worthwhile creativity. Even with both imagination and knowledge available, but without the ability to evaluate, synthesize, and develop our potential ideas, we again achieve no effective creativity. Thus, creative productivity is a function of knowledge, *manipulated*, *evaluated*, and effectively *developed* into usable ideas.

Torrance and Harmon (1961) found that students used knowledge more creatively when it was learned with a "creative set" rather than with a "memory set." Students with the "memory set" were more restricted in finding new implications or more applications for the knowledge. Hyman (1962) finds that information, as such, may not be as important to creativity as the way one seeks and receives it--as well as how he deals with it.

Teachers show an increasing awareness of the need and the opportunity for encouraging creative behavior (Miel, 1961; Zirbes, 1959). However, in spite of this increasing concern, our present educational system, to a large extent, still overlooks the *intentional enhancement* of creative ability in students. Although there is much emphasis on creative films, demonstrations, programmed materials, and other creative approaches to teaching, relatively less is being placed on *teaching for the development of creative behavior* as I defined it. Most instructors would be hard put to tell what their courses do, *specifically and deliberately*, to develop this behavior.

Harold Rugg (1963) writes, "We have had millions of hours devoted to training in solving problems by reasoning, but almost none devoted to cultivation of the imagination." And yet, Jerome Bruner (1960) states, "It is my hunch that it is only through the exercise of problem-solving and the effort of discovery that one learns the working heuristic of discovery. . ." What is unclear, he thinks, is what kinds of training produce the best effects.

Williams (1963), summarizing a variety of investigations, states that these studies have been consistent in their findings about the frequency of certain behaviors between teachers and pupils. Approximately one-half to one-quarter of the total classroom time was spent in telling students what to do. Another quarter was spent in providing information, much of it administrative. Only five per cent was devoted to reinforcement of the students' responses. (Reinforcement for creative responses was almost completely lacking. In addition, the teachers allotted only about one-and-one-half per cent of the classroom time to decision-making functions.

And yet, Torrance (1960) states that more effective teachers in experimental mathematics courses (SMSG) noted more hypothesis-making and evaluative thinking than did less effective teachers. H. F. Harding (Parnes and Harding, 1962) emphasizes the students must learn the skills of inquiring, imagining, incubating, expressing, selecting, and evaluating.

Several studies have shown that abilities needed in typical academic activities are relatively independent from the abilities needed in creative activities (Holland, 1959, 1962; Holland and Astin, 1961; MacKinnon, 1962a, 1962b; Taylor, 1958, 1964; Taylor and Barron, 1963; Taylor and Holland, 1964; Taylor, Smith, Ghiselin, and Ellison, 1961). Investigations also indicate that creative-thinking ability does contribute to achievement as it is currently measured (Parnes and Harding, 1962; Schmadel, 1960).

The importance of the planned development of creative behavior is becoming more and more apparent to leaders in all walks of life. Irving Taylor (in P. Smith, 1959) reports that a committee of 17 leading psychologists placed creativity and its cultivation at the top of a list of areas deserving the highest research priority in the behavioral sciences.

Frank A. Howard, Chairman of the Sloan-Kettering Institute for Cancer Research, emphasized the urgency when he cited the fact that in inventiveness, the United States ranks near the bottom of the list of established industrial countries, compared with the size of its population.[2]

The U. S. Department of Commerce has proposed extensive plans to assist university training in innovation. Daniel V. De Simone (1963) includes the following statement in his summary of a division meeting: "The basic techniques of invention and innovation. . .ought to be, but are not, among the fundamentals generally taught in the engineering and business schools. The same should be true for students of _all_ schools."

With regard to development of this creative behavior by means of new media, it is true that much imagination is often used in producing films, programmed materials, and the like. The subject-matter is presented more effectively, and perhaps for greater retention. But as to the effects on the individual's ability to use his imagination--to invent and innovate--we know very little. Donald MacKinnon pointed out that if we can present material more effectively to the learner, so that he absorbs and retains more, he _will have greater_ potential for creativity. I certainly agree.. What I am

[2] Reported in the _Buffalo Evening News_, October 19, 1960, page 70.

saying, then, is that the knowledge provides the *potential* for creativity; but it is the *imaginative use* of the knowledge that is essential for actual creative productivity. I see relatively little evidence of the new media helping the student learn how to interrelate and create from the knowledge he acquires. In other words, there is a lot of good work being done to help "fill the bucket," so to speak,--- to implant knowledge. This knowledge, however, is an essential but *insufficient* condition for creativity. There is no guarantee whatsoever that the water will be anything but stagnant once you have the bucket filled. And so I remind you of the analogy of the kaleidoscope that I used earlier. Paul Torrance tells me of another interesting analogy--the *teleidoscope*. Paul, why don't you describe this to everybody.

C: Well, the basic difference is that the keleidoscope makes patterns and new combinations only from what is within it, both the structure, the color and so forth. But the teleidoscope gets its structure from within it, it gets the raw materials for its patterns and color and so forth from the environment and changes in the environment.

S: Well, this gives an even better conception of what I am trying to bring out here. That is, there are elements within the structure of the person that are a part of his total being, his total life experience. These are played upon constantly by the external input through his senses. The person's creativity depends, then, on his ability to relate not only what he already has within him, but also that which comes from outside him. Ross Mooney, I think this fits in with a lot you are stressing in your own particular language. I am referring to the development, through education, of this relational ability, in addition to the ability to fill up the mental bucket with knowledge.

Consider the film we saw, after which you commented, "It's a pity that they didn't stop the film before providing the answer." The film asked a question, but then didn't give the students a chance to "relate" their knowledge. Before the students could start their imaginative gears, the film answered the question. And yet the film is a beautiful example of implanting knowledge effectively. That is an important part of our educational process, and I think there is a lot of good work being done in this respect. But the correlary work that is *not* getting as much attention as it needs is the creative teaching that strengthens the *relational* ability of the student—the ability to imaginatively interrelate the knowledge. This is what I referred to before as "teaching for creativity-development."

Creativity might be considered a function of K, I, and E, with K being knowledge, I being imagination, and E being evaluation. Under E, I am not only talking about judging ideas, but also about implementing them. A mathematician-physicist who attended one of our Creative Problem-Solving Institutes has written an unpublished paper which presents the thesis that it is more fruitful to work on the *I* than on the *K*. Not being a mathematician, I don't understand the complicated mathematics he presents. But I could agree, too, that you can create *new K* out of the old *K* you already have, by means of the *I*. Thus, if you can strengthen the person's "relational" ability, he can make some of his own *K*, so to speak, at the same time that he's taking in additional *K* from the outside. Any reactions to that?

C: Well, when you said that was a creative teaching example you gave, what you saw was a more effective way of providing information.

S: Right. I saw that as being the more typical emphasis in so-called creative teaching.

C: How do you know this? Is this a kind of intuition?

S: No, no. I'm just taking their word for it. I think they've done a lot of research on some of these visual aids, haven't they?

C: This is what the evidence is that I called your attention to the other day is that we like to think that what is prettier, more aesthetic, more satisfying to the teacher stimulus may not in fact be more informative for the student. A lot of this appears to be cues in the material which make the teacher say, "Oh this is wonderful, this is great." It's knowledge as far as the unsophisticated student is concerned. So the plea I've tried to make is that it's the evidence on the part of the learning from students that is the real measure of this.

S: Well, I was thinking more than anything else about programming research. Now I am a little bit more familiar with this there seems to be some evidence to indicate that programmed information is absorbed better or more quickly than unprogrammed information. Is the research reasonably conclusive on that or not?

C: Yes, but we must have the students participate.

C: If you want to go to the evidence as far as participation is concerned it is not conclusive. In fact even the definitions of the terms are not clear.

S: Suppose you have a set of facts that you want to teach--you want to teach the alphabet, or you want to teach how to spell certain words.

C: Well, I mean there have been studies run on whether a person learns more by participating. In other words there have been attempts made to study various levels of response under participation. As far as significant differences in learning because of participation, the evidence does not hold up.

C: Well, I think for one thing that with film media research it has been definitely shown that audience participation, be it whatever kind it is, will statistically hold up more learning on whatever it is you're getting at results than over just passive behavior.

C: I don't think so. The people at Penn State said that the only consistant, the only way that ever had, the only way they'd ever found, the only technique that has ever produced consistantly more learning was two showings of the film. That any other techniques that they tried did not produce consistant learning. This is right from the people who've done it. This is Vanderneer that summarized his findings.

S: Well, if this is so, I've been giving more credit than is due. But this won't hurt my thesis at all. I'm just surprised at this. Let's consider the film on the storage battery that we saw earlier. I assumed that, as against presenting a printed page explaining the information, there would be greater absorption of the information by means of the visual presentation in the film, which is further reinforced by the running commentary. You say this is not necessarily so?

C: In a recent study at U.C.L.A. on the effects of props in learning and transfer Trucker used four treatment groups in various combinations providing complete and incomplete rules, and complete and incomplete examples in teaching coriography. In other words he was trying to use examples and rules under all conditions. He also had a control group. He found differences among treatments when the criterion was a transfer to a new example test. Now this is a coined word where the examples were of the previously taught rules. In otherwords, here's a whole bunch of letters and these kids have to unscramble them and there are certain rules for doing this. Then they get new examples and they did pretty well. However on a different criterion, test involving transfer to substitutional rules, which is in my estimation, a test requiring a creative solution which required a new set, a new pattern, because of the substitutional idea, they found that the control group that received no instruction at all scored higher than any of the groups taught coriography through any of the experimental methods of problem solving. These people were taught to solve problems through all the combinations of techniques that they thought they could teach people to develop.

S: And what were the control groups taught them?

C: Nothing.

S: You mean they just gave them the problems.

C: They just gave them the problem. They solved it better than those people who'd been taught problem solving under all conceivable ways. In otherwords, you can give people rules for solving problems and you can give them examples and you can have the example first and the rules last or the rules first and then examples or partial examples and let them creatively find the answers. What they found was that the control group on a transfer task with substitutional rules that was not taught anything solved the problems best. In other words, in teaching people to solve problems, we sometimes create mental sets, we teach them techniques which actually interfere with their ability to solve problems. This is the evidence from this study.

C: Not to further confound this, but I think we have to take into account the fact that we are in a time when there are attempts made to provide series of instruction for whatever effects they find. I have to admit that there can be instruction without learning if you're not pressing for definitions here. There can also be learning without instruction, and therefore if you follow this analogy there could be creative instruction without learning and creative learning without instruction. I think these are conceivable things but irrelevant perhaps to media.

S: Well, one other criterion that I also have in mind when I say "creative teaching," is the degree of interest on the part of the student. I think that some of what I call creative teaching is enjoyable to the student. In other words, learning can be fun.

C: This is entertainment.

S: WEll, it might or it might not be. I'm not talking about it as entertainment, but I'm just saying that the student can enjoy it intellectually. What is entertainment?

C: Well, the difference would be learning is normally conceived as some sort of change in the behavior of the learner. If our purpose is not to modify this behavior, but to amuse the learner in some way, this kind of a stimuli presentation is the way I've been defining amusement, or entertainment.

S: Well, let's compare a standard lecture, for example, with a TV program that introduces very effective visuals along with the lecture. Can this be done without it being "entertainment?"

C: Then it contributes to the learning situation. I have no objection to that. If it helps even in an indirect way of keeping the person participating or something like this, then it's necessary for the learning. So long as we don't entertain for entertainment's sake.

C: No matter what kind of a system you set up, creative thinking is a way of making an analysis of the structure of the task to be learned, an analysis of the learner, but then it's not complete until you have something to motivate the learner to engage in this sequence of experience.

S: And Jack's point is that if you have motivated him, then he will engage and there will be learning as a result. Is that right Jack?

C: Well, all my work is on motivation. I mean this is my major interest so I am not depreciating this at all. You know, you've got to have action, you've got to move the learner. You've got to create the conditions to distrub the homeostasis somewhere.

S: Isn't it conceivable that the content mastery could be the same but that in one situation the student enjoys it and in another situation he does not enjoy it?

C: Sure.

S: Then, even if there weren't a better mastery of content, I would like the enjoyable situation better. Ultimately, too, I think it would prove to be more effective learning as time goes on, because it would provide the motivation we're talking about.

C: I am a little disturbed about our goals because I thought we were working on goals of eventual learning to learn. Actually most of what we're interested in, even in the small bits that we do, we want to have them contributing to this overall goal of learning to learn. The process that's started and nurtured within the individual of continuous learning. Now, I personally don't want to lose that with anything inbetween. I may not know how to get it, but I think this is one of our goals. On the other kinds of things again

Ihave been very disturbed this year in going through the studies of how little we know. I think the handbook on teaching presents the new material quite finally in a sense that for most of the changes in method, for most of the things that we've done, there's nothing definite that these make any difference. In other words, I think we're still seeking for what makes the difference. .

S: Well, at any rate, when teaching is done in ways that impart information more effectively and in a more interesting manner, this, to me, is not enough to qualify it as "creative teaching." In teaching for creativity-development, you are using the internal resources of the student in creative ways, rather than, or in addition to, using creative external media. Teaching for creativity-development is where something creative happens within the student rather than where something creative happens in front of the classroom.

C: You're making the same point we are.

S: Am I? It took me a long time to do this!

C: It's just a question of the way of communicating, I suppose but there is a mental set that you have, that this is the same point looked at from your stand here.

S: Well, that's exactly the way I've been looking at it; so I am glad you cleared that up. On this whole matter of creativity in the classroom and the timidity of some teachers to creativity, I have often asked myself these questions: Is the timidity because such teachers do not acknowledge the importance of the I factor, but just do not have any idea what to do about it? I think this is one of the dilemmas we face when we talk to teachers about developing imagination in students.

C: Do the teachers really worry about the interviewing processes or are they more interested in the end product, the behavior is correct, so the kids learn to read and they really don't care what goes on so far as methods or the effects of their teaching so long as this youngster learns to read.

S: I think you people could answer that better than I could.

C: Some studies we did on learning and teachers in first grade, teaching those kids how to read, it was quite apparent that first grade teachers have different styles of teaching and have very different effects on youngsters. For example, some teachers teach in ways where there's fairly a high correlation between intelligence of the youngster and their reading proficiency. Others teach in ways so that there is a relatively low correlation between intelligence and reading proficiency. Yet, if you take the mean proficiencies, or mean achievements for different grades you'll find that the average achievement for two classes about the same, but the way that achievement is attained is quite different. The influence by the teacher upon the individual youngsters in the class is quite different, and as you discuss this material with the teacher they are quite surprised that this should be the case. In other words, they really don't analyze the process that goes on. All they are interested in is that the kids in their classes learn to read.

C: I think that there is just an awakening to this in the last few years in terms of serious research. I'm sure that a lot of people have sensed that there are differences like this. It is now starting to come up to the surface, we're knowing more about it.

C: Well certainly some people were reading Piaget years ago and some people have just started reading him. For an example Fall's study done way back in the early '30s and we had Buswell in '27 who interviewed children looking into their processes in mathematics as a way in working with children. Now it's much more legitimate to work that way, more meaningful to a larger number of people, I guess.

C: They have also suggested that there have never been direct targets.

C: Yes. This is one reason I think it is very important to restate our goals.

C: Speaking as a creative act the one thing it allows is for the individual to come to a focus with what he has to bring. And almost the clarity with which he's able to come to focus is in a sense a measure of his capacity to communicate through that, so he should have a chance to come to his own differences. And this should mean the individual differences among teachers which should be a common thing or expectation that's fortified and developed and in so far as that's recognized and honored among teachers. It's easier for them to honor it among the students and easier for students to see that it's honorable to be so developed oneself.

C: I think as I review this dream, and to some extent my dream is that a single teacher can incorporate into a more or less wide repertoire of a self-contained classroom. You know there is an authoritative identification kind of way and there are certain people who have done very well, and then there are others who don't, and then we change to the other and it kind of reverts around, so if you broaden your repetoire you broaden the changes that more people in the class will be able to learn.

C: The kind of analogy I've used is that the teacher has many keys, potentially many keys on which he or she can play, and the student has many receiving and learning and thinking keys on which he can play and if the teacher isn't reaching some of the class, then the teacher ought to shift to some other keys, and try and reach some of them and the student who isn't matching ought to try flipping over some of his other keys and seeing if he can't make contact.

C: Then when we check out which way we have gone whether we have accomplished anything we must not limit ourselves to one way of measuring the outcome.

C: This makes a point of the relevancy of media to the very point you're raising and that is that the teacher has got to have this role as both of you are dreaming about. The thing that'll make it possible for the teacher to play this role is that many of her other duties can now be performed by media, that of the information transmission role, the entertainment role, the mother role or whatever other roles the teacher has to play that prevented her from playing this very key role with individuals, can now be performed by media.

C: . Media can be used to broaden this repertoire.

C: To broaden the capability and the capacity of the teacher to perform many other roles.

C: But where the real problem, if I read it right, is that the media have been able to constitute within themselves a matching to what teachers have done to a great degree so what's left over is what many teachers have not yet known what to do.

C: The research is very clear that if you take the behavior that the teacher performs, just the teaching act in the classroom by the functions that the teacher performs the wider repertoire a teacher uses apparently the better the teaching is. So that this is, the creative adjustment to the data the students are putting into the situation, the adjustment to the content. I mean maybe you do behave differently today in mathematics than you did yesterday in mathematics, etc.

C: The thought that comes back to me on the rebound is that maybe your instructional media people have missed their real problem. It might be easier to design instructional media to match the rare things that are done by a few master teachers than to match the things that are done by so many teachers because you create less of a dilemma this way and you cover the gamat easier.

S: This may be what we're accomplishing in our programming research. It may be that conentionally programmed materials tend to stifle the creativity of the individual. I don't say that this is so; but there have been feelings expressed that this might happen. Programmed materials often give a feeling of finality to an answer. But, of course, so does a textbook, depending upon how it's written--the way the words are used.

C: Neither needs do that.

S: Right, neither *needs* do it; but so many of them *do* do it. Therefore, it behooves us, as we invest heavily in new and expensive programmed materials, to *incorporate* [illegible]lopment of the imagination with the mastery of subject-matter. The thesis, then, that I alluded to the other day, is the notion of a prime "medium" being the imagination of the student. It is commonly accepted that any instructional medium must first engage the student, capture his attention, and so on. What could possibly capture the student's attention faster, more completely, than his realization that he has the power to discover--to create knowledge. Thus he has a "built-in medium" for the teacher to use--his imagination--the nucleus of his mental energy.

Mrs. Toni Paterson, of our Philosophy Department, is working with us on our programming research. She and I were toying around with the idea of the imagination as a teaching medium, when Mrs. Paterson came up with the notion of "self-comfort." She quoted Bacon as saying, "Nature to be commanded must first be obeyed." She then quoted Spinoza, "And man is nature." She concluded, "We synthesize these principles into our new medium of self-concept as an instrument of education. If we want young human animals to command their nature, we must nourish their necessary acts towards obedience to that nature. Too much of our effort has been wasted trying to command their nature for them, out of obedience to our own cultural stereotypes. We wind up fighting the student. Eventually, in order to get along, he gives up the 'self-comfort' image and burys the comfort-urgings out of guilt and shame for having them. We have forced him into imaging an unworthy self--a hostile self. We have forced him into hiding that tortured self away from everyone. He lives alone with his miserable secret. All this guilt and anxiety drains off large quantities of his creative energy. In education, we work with only a trickle of this creative flow because we have dammed up the river of self which contains that powerful mineral--imagination."

Our research in creativity-development at the State University of Buffalo, as well as that of investigators like Maltzman, Torrance, and others, demonstrates that deliberate methods can be used to release this latent creative power within individuals--to put the student in better communication with himself--to help him to use the pre-conscious in a habit system. I have gathered, over the years, a number of beautiful expressions as to what this "communication with self" means to the individual and his self-actualization. I will include these in a footnote.[1]

---

[1] A. H. Maslow: "A truly integrated person can be both secondary and primary; both childish and mature. He can regress and then come back to reality, becoming then more controlled and critical in his responses." (1959)

Hans, Selye: "Instinct and intellect forever despise each other, for one only does, the other only knows why. Genius builds bridges between instinct and intellect, between feeling and logic." (1964)

Alfred North Whitehead: "Fools act on imagination without knowledge: pedants act on knowledge without imagination. The task of a University is to weld together imagination and experience." (1929)

Frank Barron: "Primary process thinking to the exclusion of the secondary process marks the original but unintelligent person; secondary process thinking which carries ego-control to the point where the ego is not so much strong as muscle-bound marks the intelligent but unoriginal person; and easy accessibility of both primary process and secondary process marks the person who is both original and intelligent." (1957)

E. V. Carne: "The young graduate is quite literally found to be handicapped by the one sidedness of his education. His cerebral cortex is more or less adequately equipped with learned data and procedures. But he is handicapped in autonomic initiative and constructive thinking, for there was neither time nor acceptance for their practice in the curriculum." (1960)

E. M. Standing (re Montessori): "Montessori seeks as the goal of freedom the ordering of the inner life of the child as well as the ordering of the relationship existing between the highest activities of the mind and those primitive sense activities so brilliantly described and analyzed by her under the name of "sensorial foundations." (1962)

Samuel J. Bois: "I am now the living cumulative result of my past and the active sum total of my future, anticipated consciously or unconsciously. When you touch me by a statement, a gesture, a handshake, a kick, or a kiss, you establish a contact with a space-time living totality that reacts with everything that it has been, is, and anticipates being." (1957)

Harold Rugg: "Instead of concentrating on conscious mind, as do the pragmatic problem-solvers, the men of Tao subordinate it. Their endeavor is to create conditions that will favor letting things happen, while ours of the West is to create conditions that will make things happen." (1963)

(continued on next page)

Research and development at the State University of New York at Buffalo during the first ten years of our study of creativity-development was concerned with pilot experimentation and the development of courses, programs, and methods designed to stimulate creative behavior in students.

After the period of preliminary exploration, an extensive research effort was begun in 1958 to evaluate scientifically the results of these methods and programs. During these past seven years, as new knowledge was gained, intensive development activities paralleled the research efforts.

Research dealt with:

(1) the effects of a semester's program in deliberate creativity-stimulation.

(2) the effects of extended effort in creative problem-solving.

(3) the effectiveness of the specific creative problem-solving principle of deferred judgment.

The principle of deferred judgment calls for deliberate deferment of judgment during idea-finding in order to prevent premature judgment from hampering imagination, judgment being applied after a wide variety of alternatives is listed. This principle is equally applicable to individual idea-finding effort and to creative collaboration by groups. Studies covered the use of this principle both by individuals and groups.

---

[1] (continued) Michael F. Andres: "When the objective and subjective levels of the mind come into a symbiotic integration the mind is creative." (1961)

Frederick Schiller: "In the case of a creative mind, it seems to me, the intellect has withdrawn its watchers from the gates, and the ideas rush in pell-mell and only then does it review and inspect the multitudes." (1938)

Major findings at SUNY/B were as follows:

(1) The semester program resulted in significant increments on the two measures of quantity of idea-production and on three out of the five measures of the quality of the ideas produced. In general, these increases in creative productivity remained evident in another group of students who were tested from one to four years after taking the course. A significant increment on the California Psychological Inventory Dominance Scale also resulted from the program.

(2) Significantly more good-quality ideas were produced by individuals under deferred-judgment instructions than under concurrent-judgment instructions. (Criteria included uniqueness and usefulness of ideas.) The subjects trained in a creative problem-solving course emphasizing the principle of deferred judgment produced a significantly greater number of good-quality ideas when using the technique than did the untrained suudents. (The same criteria were employed.)

(3) Groups producing ideas on a creative problem-solving problem were more productive of good-quality ideas when adhering to the deferred-judgment principle than when employing the more conventional discussison methods which entail concurrent evaluation of ideas. Groups which adhered to the deferred-judgment principle when generating ideas were likewise more productive of good-quality ideas than the same number of individuals working independently under conventional methods which entail concurrent evaluation of ideas.

(4) Extended effort in idea-production resulted in a greater proportion of good ideas among the later ideas produced.

The new knowledge derived at SUNY/B and elsewhere has been incorporated into its developmental activities. Annual Institutes have been held for the past ten years at the University for the study of research and developmenss in education, industry, government, and national defense. The knowledge resulting there from has been integrated each year within new programs at the University. Experimental instructor's manuals and workbooks have been developed and constantly revised over the past seven years. Presently, incremental self-instructional materials are being created and tested in a variety of instructional settings.

Incidentally, a new study on deferred judgment has just been reported in the June issue of Applied Psychology (Brilhart, 1964). This study supports our findings regarding the effectiveness of the deferred-judgment principle when used by groups. Brilhart not only tested deferred judgment versus conventional thinking, but he also added a third condition, wherein a third experimental group used deferred-judgment, but under different circumstances than usual. The members of the group first listed criteria on which they would evaluate their ideas; then they deferred judgment and listed their ideas. The most effective results came under the condition where the criteria were not listed until ffter all the ideas had been conceived. This latter condition is the recommended one for group brainstorming sessions.

The report of Brilhart's research should further help clarify the misunderstandings in the literature about the meaning of Donald Taylor's study (1957). I attempted earlier, with Taylor's blessing, to clarify the matter in a brief article entitled, "The Deferment-of-Judgment Principle--A Clarification of the Literature" (1963).

C: A related, rather interesting study by Marsh Pollock was that not only did they get responses that people wrote down but they tape recorded the session and what they found was when you encourage the deferred judgment kind of thing (free-wheeling and so forth) what they wrote down, fitted right in with your research. When they picked up the other things that people came out with orally in the session and showed up in the tape recording they found that the other group was coming out with as many ideas and original ideas but they weren't writing them down, and he maintains that it is not so much the deferred judgment principle as the lowering of the standards in judgment. These ideas were popping up but the people didn't either think they were important enough to write them down, they were too wild to write down, or something so they didn't get that on record but they were on the tape recording.

S: You mean somebody was serving as a secretary and was writing down only what he thought was significant?

C: This is the usual kind of thing when you have a human recorder.

C: In a sense they aren't deferring judgment then are they?

C: Well, I argue that they are lowering the standards of judgment.

C: Can you define deferring judgment for us?

S: Yes, I have recently thought of an entirely new way to talk about this principle of deferred judgment. It occurred to me that instead of literally deferring judgment, we are, in reality, using "limited-criteria" thinking--these "limited" criteria being dependent on the way we state the problem. For example, we never say, "List ideas that come to your mind by free-association." Instead, we say, "List ideas with respect to such-and-such a problem." When we "List uses for a broom," for example, we are setting the criteria of "uses" and "broom" in our minds as we allow our automatic associative processes to go to work. In other words, we are saying, "I will entertain any idea that comes to my mind with respect to using a broom in some way." For example, I tried thinking of uses for a broom, while deferring judgment. My first thought, for some unknown reason, was, "A broom is beautiful." This thought just "popped" into my head. The next thought that entered my head, because of the fact that I had the notion "uses for a broom" in my mental computer, was to make decorative borders for a garden out of brooms. Thus, the aesthetic qualities suggested by the first idea brought about an association with "garden" and thus resulted in the second idea. Notice that under deferred judgment, I would list this second idea, "Make a decorative border around a garden out of brooms." I would list the idea without concerning myself as to whether it was a good use for brooms. But I would not have listed the first idea, "Brooms are beautiful." Hence, you see that I am judging (and ruling out), automatically, any thought or idea that comes to my mind that is not pertinent to "uses for a broom."

So I realize now that one does evaluate when supposedly "deferring judgment." However, he evaluates almost automatically, against certain predetermined primary criteria ("uses" and "broom" in the example above). He does not restrict himself with secondary criteria that people would normally use along with the primary ones. For example, he doesn't say, "Think of uses for a broom that wouldn't be too expensive to carry out, wouldn't be too hard to do, wouldn't take too much time, wouldn't require too many people in the process, and so on." The latter criteria are secondary criteria that one does not bring in while deferring judgment. Therefore, the principle of deferred judgment really implies the following: use only the primary criteria in your statement of the problem. Let that establish your boundaries for your mental search mechanism. Let your mental computer go to work within those boundaries; and everytime an idea pops up that is within the boundaries, make a record of the idea. If the idea is outside those boundaries, let the associative processes continue until they trigger another idea that is within the boundaries. Make a record of each idea that occurs within the boundaries set by your criteria, as implied in the statement of the problem. This reminds me of Guilford's comment, "The way in which the problem is comprehended sets up search models which serve as cues for the retrieval of stored information."

When we use deferred judgment, we "free-wheel," so to speak, within a framework; but we set a very loose framework--as loose as the circumstances will permit. In other words, our only evaluative criteria are those which are explicit in our problem statement (e.g., "uses for broom").

C: You have set up a search model when you said even "broom" and "uses." I get a lot of stuff in my mind that might be relevant that doesn't come under those initial scanning criteria. I think you should experiment with the principles of suspended judgment and its various parameters which are not cued to any stimulus criteria.

S: You mean experiment with another one where I write down "Broom is pretty" and all that?

C: No, drop the uses or anything--forget the problem if you can. I'll tell you what the problem is later.

S: Just free-associate?

C: What about a broom or get things down on the Ouigi board.

C: I've been trying to accept or reject brainstorming for a decade and for the first time now I realize this is free-association to the object "broom" and to the term "use."

C: Except that you're always hanging back to that given one. Each cue becomes a thing you associate from as you produce.

C: Why not give any cue as a stimulus. We haven't experimented with these things nearly enough it seems to me. I think poets sometimes fall into doing this, composers do, artists do. But this random experimentation is not random for long. I guess psychiatrists do it too.

C: I think it's never random--that's why a psychiatrist pays attention to every association.

S: Well, I said that "other uses for a broom" was the problem. You say "Start out with nothing." How can you start out with nothing?

C: You just start out with broom.. . . .

S: All right, start out with the broom.

C: But after a while you lose this cue of broom but the brainstormer is always keeping this in the fore-front of his mind.

C: I think Ken is suggesting another variation of this.

C: That's right the uses of the broom is already a criterion.

C: Lester Beck once took a group of floor cutting films that were unrelated--just pieces of film and spliced them together. Isolated this film just like your random thoughts and showed it to various people asking them for their reactions to it--what kind of responses did you get?

C: Well, it wasn't quite that way. We started out by being very fortunate in having a huge resource of material at USC in the cinema department where students had had camera projects there for ten years and had dumped all their camera projects in this room. The day came when we decided we needed the room and we should cart all that out to the junk pile and I said "Don't! Let me have just a little while in there." So I went in and randomly selected bits of film from all that stuff and spliced them together and I was kind of interested to see the result. Some of it was pretty good--it strung together very well.

S: How short? You're not talking about "frame-by-frame," are you?

C: No, these sequences would run for about 5 or 8 seconds. I didn't time them too clearly. A student got hold of this and got intrigued by it and I said why don't you go and read about the free-association of schitzophrenics before you pay any more attention to this. We got out all the stuff we could and began reading. So he said give me that film and he rearranged it a little bit and some of it I think is sensational. Then he put a sound track on it and called it "Id" and it's a pretty good film but it's all meaningless.

C: The relevance of this to what we are discussing seems to me is that here are all these wild unassociated thoughts--views, noise thrown out there and yet once you experience this and have seen it, it has it's effect of trying to make meaning from it. You struggle with it afterwards trying to organize it, trying to pull these bits of things together. I have a feeling in this free-association thing that you're talking about that when you throw out all these stimuli, that in the search to and in the attempt to pull things altogether something new is created, new thoughts are formed and new associations are made. You build bridges out of it someway. The more of this you have as stuff to build from the more chance you have to get some unique creative solution.

S: Right, but my point is this: In problem-solving, I'm faced with some difficulty, some perplexing situation. I've got a warehouse full of these brooms and my creditors are closing in on me. What am I going to do? I don't see how I can start free-associating, "Bird," "tree," etc. "Broom" is going to remain. This seems to me to become almost a sub-conscious screening mechanism that allows you to go only so far in your associations.

C: It's not completely free association--you have some restrictions on free-association and you can build your fluency tests so you have 0 or 1 or 2, 3, or 5 restrictions on them. Incidentally, your film would be a good one to go around and find who's associational processes match.

S: It also might win in a modern art museum.

C: I have seen a couple of cartoons that have been created this way. This is a non-verbal form of the test like we had which we pulled randomly from the dictionary by putting them down in a list and told people to write a story by using these words. We put no restrictions on it except to use the words in sequence. Ghiselin took it as a challenge once and he was able to use the words up in sequence in fairly short order.

S: It just occurred to me that when Alex Osborn says, "Break down the problem into bite-size pieces," this could actually mean, "Set more criteria for your mental search mechanism." Take the example of, "How to promote a new pharmaceutical product." One of the Creative Education Foundation's pieces of literature suggests breaking down a problem like this "to the doctor," "to the pharmacist," and "to the consumer." The publication advises using deferred judgment on each of the three sub-problems. The first such sub-problem would then be, "How to promote it to the doctor."

Now, isn't this the same as saying, "Add the criterion of "to the doctor" to the earlier two criteria of "promoting the product." That is, delimit yourself so that no idea is noted unless it fits the new criterion, "doctor," as well as both of the two former criteria; all other ideas should be used only as associative mental links.

I am going to try this out, verbalizing everything that occurs to me as I defer judgment while thinking of "How to promote this new pharmaceutical product to the doctor." My first thought is, "My wife would like to buy this in a pretty plastic tube;" next, "My wife is pretty;" next, "The item could be promoted to the doctor by supplying a pretty little container that he can give to his wife after he gives the samples to his patients."

Notice that if I had been in a brainstorming session, I would have been associating ideas, without even realizing it, for X number of seconds, until suddenly this final idea would have come to me (regarding the "souvenier container for the doctor's wife"). This final idea evolved from a series of associations; but I would have written or spoken only the one final idea--because of the fact that my criteria had been set in the problem-statement to include "doctor." Any other thoughts that entered my mind were only raw starting points to a final idea that focused on the notion of "promoting the product to the doctor." (I wonder if we don't almost "precondition" our mind by means of the clearly defined problem-statement, so as to allow a kind of sub-conscious screening-mechanism to work for us?)

Perhaps what happens when we narrow down our definition of the problem, is that we force ourselves to do more relating. That is, I am wondering whether we tend to become forced into relating ideas from other associations we form, in the way I related the other thoughts to the doctor's souvenir container for his wife. Maybe we force ourselves to make relevant that seemingly is irrelevant by specific "criteria-loading" in the problem definition. I say "criteria-loading" here in the sense of loading our "mental computer" with a set of criteria that then becomes an almost automatic search-mechanism for ideas. Because our mechanism is geared to searching in a narrow range, we quickly exhaust anything we know in that narrow range and we seek relevancy among things that are outside the range. We pull these associations into focus, to to speak, in the way I have pulled into focus the notions that "my wife likes pretty things," etc. Thus, we are forced to make new associations--the basis of the creative process.

C: I want to go back to a previous idea. It's one that I was working on in ideational fluency. Some studies talked about flow versus selection and the usual thought is selection means expressed or not expressed. See that means you keep it within yourself or get it out, but the study you're talking about there isn't much different in expression but just different in selection among the things expressed which get recorded. That's the second stage of selection.

C: The association I have here is that this again fits beautifully in a very good expansion of one of the concepts in Guilford's Model in dealing with production. You're getting at the technique for getting the mind to produce, for ways of avoiding inhibitions, and how to get the optimum of creativity in this one phase of the process.

S: Right, but it's interesting that it works in all phases of problem-solving.

C: You're really saying that it is selection and revision in the process of expression. That is you're trying to make more things relevant as you produce them.

S: Yes.

C: So there is a form of judgment going on in the sense of selection and revision as a kind of guidance to get yourself within this realm.

S: Let me try to apply this theory I have expressed to the total creative problem-solving process. We start out by saying, "Don't settle on the statement of the problem too soon. Search for all possible definitions of the problem; get the broadest possible statement." Well, in a sense we are saying, "Start with very few criteria--the smallest conceivable number of boundaries for your thinking."

For example, consider the extremely broad problem, "How can I achieve the fullest, happiest life?" Here I have set very broad boundaries, albeit boundaries. I want to allow my search mechanism to roam freely. I want to "stay loose," as General M. K. Deichelmann once put it! So I explore broadly for alternative approaches. Then, after I have swept broadly with my searchlight, and have looked over all the paths I might take, I decide on the avenue that looks most promising to explore in my search for my solution. The selection of thispath adds further criteria ("boundaries") for my next search.

Let's reconsider the example of the broad problem of achieveing the fullest, happiest life. Suppose, after listing many alternatives, I decide to explore down the path of "achieving the fullest, happiest life through my associations with my immediate family." Now I have added the criterion that any idea must relate to my immediate family. If I then think of the idea, for example, of going off to a deserted island, my search mechanism pulls that back into congruence with the criteria. Thus my search mechanism combines "my family" with "deserted island" and I suddenly picture my family on this deserted island. Then I visualize a Caribbean cruise. Next, I picture building an "island" patio in the backyard, with a moat around it,etc. In other words, I am bringing my wildest ramblings of thought into focus with what my "computer" has set as a range within which I am allowed to search. This results in ideas that "marry unreality," so to speak, with the reality of the set of criteria with which I have limited myself.

After I have conceived many ideas with respect to this notion of achieving the fullest, happiest life with my immediate family, suppose I find an idea that really intrigues me. It is to build an "island retreat" in a country setting. Now I am off on another exploration; but I have loaded my mental computer with an even tighter set of criteria. Now I have the notion of "happiness with my immediate family in a country setting to resemble an island-hideway." Within this context, I probe for new ideas. I have now set very specific criteria, and as my associations flow freely, these criteria help me to relate "extraneous" thoughts until they become relevant. My detailed criteria "pull back" my free associations and relate them to the problem as now defined.

I work within this relatively narrow kind of beam of "happiness, family, country setting resembling an island hideaway." I start to think: (1) find an inexpensive piece of property, (2) get the children involved in fixing it up, (3) invite some of our friends over for "fix-up-the-property" parties, and (4) a pirate-party. Now where did pirate come from?! --- I suddenly thought of Wisconsin and a pirate party the students were having when we were at the University of Wisconsin last summer. I think of those pirates and my mind wants to go off on a complete adventure about pirates; but again my criteria -- the "seachlight" that I have set up in my mind -- say, "pirates in relation to family and happiness and this desert-island concept." So I think of a costume party for our friends, and of many other things we could do to have happiness in this remote hideaway. (I think the idea here is clear, even though my ramblings may be getting madder and madder in their nature!)

Thus this spontaneous thought process may demonstrate that creative problem-solving is really a selective evaluative process. It involves the ability to generate ideas within ever-tighter frameworks as we progress toward the solution of a problem. We work constantly within a set of criteria from the beginning to the end--never in a completely unevaluative atmosphere. Instead of calling our process the principle of deferred judgment, we might call it a kind of "limited-criteria thinking," --with the limited-criteria becoming less and less limited as we go along, until we come to the final idea which meets a very rigid set of specifications. This chart, on the following page, may demonstrate the concept.

When we advocate deferring judgment, we really mean to defer judgment on any idea that satisfies the criteria inherent in the problem statement. In other

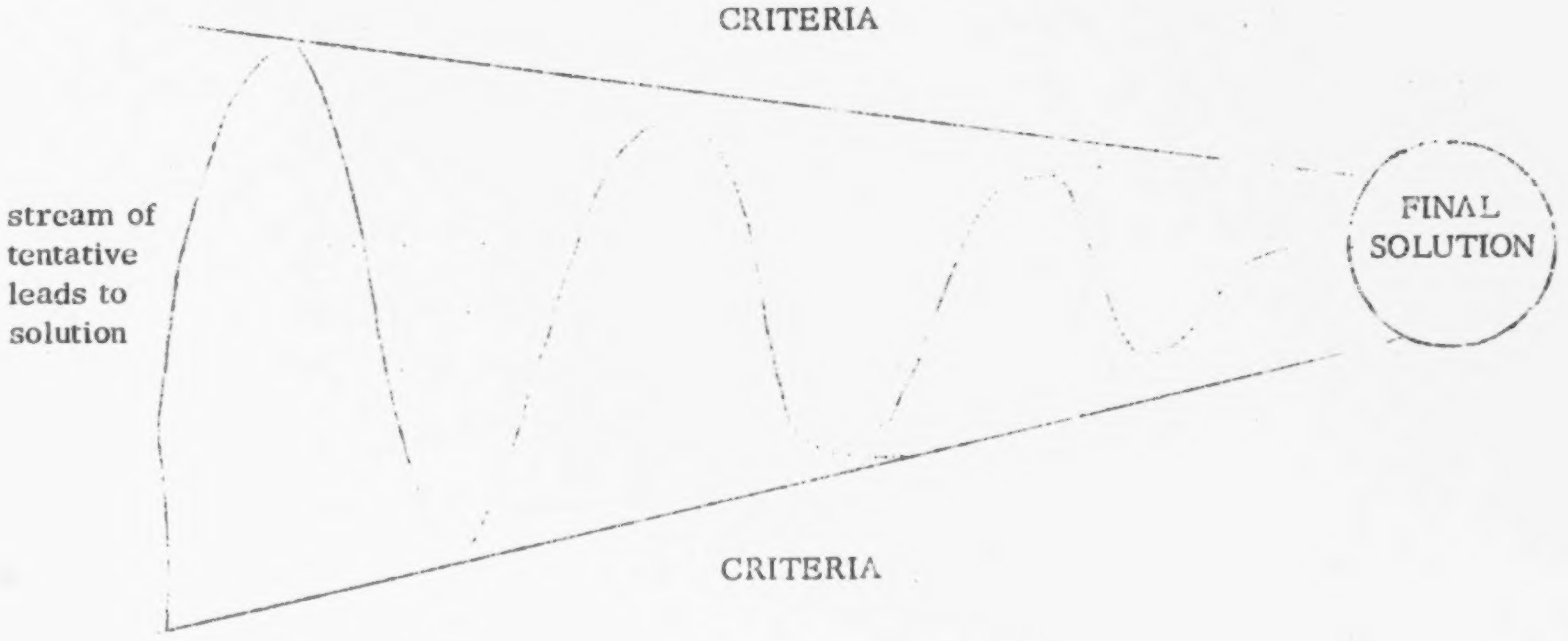

CRITERIA
stream of tentative leads to solution
FINAL SOLUTION
CRITERIA

Figure 1

words, we would list a "bad" or "mediocre" idea as long as it was pertinent to the problem-statement, whereas in conventional thinking we would not. For example, if I were considering other uses for the broom, I might think of the notion of swinging it around over my head with a string tied to the end of the handle (perhaps as some sort of a game). Under conventional thinking, my first evaluation of this would be, "no good, not practical, not worth anything," and so I might not list it. However, if I were following the principle of deferred judgment, I would list it. I would list it because it fits the primary criteria of "uses" and "broom." Perhaps what is happening here is that, by listing the idea, I may increase the likelihood that I or someone else may derive a new association from it. This would become especially important in group problem-solving, where the idea must be verbalized if it is to suggest a new association to another member of the group.

I have a feeling that as a person becomes more experienced with creative problem-solving and the principle of deferred judgment, he will do more of the "changing" or a poor or mediocre idea into a good one in his mind, without writing down the poor or mediocre idea. In other words, he mentally "plays" (associatively) until something approaching a good idea comes out. Referring to the kaleidoscope analogy, he spins the mental drum and watches the panorama of patterns, picking up the interesting ones as they occur. It would be fascinating to me to explore these ideas I have suggested with people who have extensive experience in using the deferred-judgment principle. As I reflect on this, I do feel that I operate the way I have conjectured. Perhaps the sketchy theorizing I have indulged in may suggest new experiments to you or to readers of our conference report. At least, I'll be interested to look back at my thoughts later and see how I may interpret them further.

It might be appropriate, in concluding my discussion, to re-emphasize that the self-fulfilling approach I have been describing does not minimize the need for subject matter. You can accomplish the two concurrently; you can provide for subject-matter mastery without denying the opportunity for self-fulfillment. The teacher can be trained to use more fully the medium of the student's imagination. Educators have too frequently been accustomed to pouring in from without, rather than drawing out from within! The teacher may have to learn to serve as a kind of counseling figure to the student.

Psychologists and others have talked long enough about the notion of tapping both the primary and secondary processes in students, as I noted earlier. It is time these theoretical emphases be brought into actuality by providing the classroom experiences that will allow for this self-actualization. The processes and materials of creative problem-solving hence become an educational medium that can be introduced to more and more teachers.

What is being done in these creative problem-solving programs is that the individual is being placed in an environmental setting which allows for complete self-acceptance, so that the possibility exists of his tapping his own "mental library" and using his own "mental machine-shop." The basic framework of a creative education program provides the environmental turnpikes on which the individual can travel once he is released from the governors which have held back the flow of his raw imaginative processes. Carl Rogers' "psychological safety" and "psychological freedom" allow for this kind of inner-searching. Therefore, we must provide this kind of psychological safety and freedom in the teaching environment. In such an environment, the student will more often experience the thrill of discovery.

I can't help but think of the relationship of what I have said to the whole question of automation and what is happening with our increasing leisure time. When I hear people bemoaning the fact that automation is replacing jobs, I understand the short-range problem; but I am frustrated because of the over-looked opportunity that is provided for education to become life. If we could expose people from "cradle to grave" to the kind of educational process where they are accustomed to tapping their own resources, then everyone could experience the excitement of intellectual inquiry throughout life. The more we could then automate, and thus free people to experience this, the more exciting and meaningful life could become for everyone!

It seems that "self discovery" can become the prime raison d'etre. If we can develop a kind of creative education which provides its own reason for being, its own self-stimulation, then the person's entire life will be built around the intense desire to learn. Just as the researcher finds the process of discoveryon the fringes of knowledge to be such a source of excitement and self-fulfillment to him, we can provide the same self-realization for everyone, at his own level, through a new kind of learning. Life then would be one continuous creative experience, a flowing and a merging of what we have with what we take in, providing fully for what Maslow calls "self-actualization."

When someone once asked Leonardo da Vinci what his greatest accomplishment was, he replied, "Leonardo da Vinci!"

C: What kind of experience did you have yesterday during the first part of MacKinnon's paper when he was talking essentially about the same notion with the Ouiga board?

S: Oh, yes, except I am not too familiar with the Ouija board. Regarding hypnosis, drugs, etc., I see all these as artificial means of trying to experience the full self which we have been denied.

C: Are you really trying to say that you are trying to now figure additions to the techniques that you have been using so that you will try to get into what Thurstone has called better rapport of your prefocal conscious?

S: To me that is exactly the purpose of these procedures we're trying now; and I'm sure we and others will think of many better methods of accomplishing this.

C: Or to make this stuff in there more viscous or something. Make the membrane more permiable.

S: Ray Hyman says that creativity comes about when someone helps us to see what Poincare has called the "unsuspected kinships" among facts that we already possess.

C: I was kind of curious about your conception of your relationship of this material which the individual reveals to himself and his prior experience. How does it come about that you have to use these techniques? What is there in the education process that produces all this that we have to search for? Why don't we teach better in the first place so we don't have to use these procedures?

S: What I'm doing is remedial work on an adult level. Ultimately, we should be able to educate children in such a way that this type of thinking would come naturally, as it would if our educational and cultural processes didn't stand in the way. Weisskopf writes, "The constant activity enforced by many educators does not give young people the leisure which is an essential prerequisite for intellectual or artistic creation. We keep the secret of biological creation from small children, and the secret of intellectual creation from youth." (Haefele, 1962)

C: It may well be of course that there is a tremendous amount of learning that is not on the conscious level right in the first place. We require a tremendous amount of information and we need other ways of reaching for what is there which is otherwise inhibited and never directly available to us.

C: If it goes in as relevant to a creative experience it will tend to come out that way. So the way information goes in helps control significantly the way it comes out. The importance of there being a creative context in which information enters is critical.

C: What is a creative context?

C: Hyman's study was deliberately that way. He had students receive information in a critical way which proved to be a destructive fashion. Their own mind set was one which destroyed information later, and they refused to use it later when they had a chance to use it in a constructive way.

S: Imaginative as against judicial; that is, looking at the information and seeing where it might take you, instead of trying to see what's wrong with it.

C: Is it so much a matter of a situation or the matter of the individual's preference for an open perception on the one hand or a strong emphasis on judgment and evaluation on the other? I think a more creative individual is open to all kinds of experiences who requires and exercises control over impulse and imagery, diffusing the mechanism of supression and repression and uses other methods of sublimitation, etc. So it seems to me that it is a matter of a personality trait that the person is open to experience a richness of experience and complexity, or whether he has an attitude that denys, rejects and eliminates a great deal of information.

C: In our experimentation we asked people to try to assume and practice a set for 3 days and then start the test. We found both sets to be functional. We found when we asked them on one occasion to take the critical set and another to take the constructive imaginative set, those who had the critical kind of preference did do better on the critical test than those who didn't have it and visa versa. We found also disregarding personality that set was still powerful enough to make a difference.

C: They had some flexibility to modify their more natural tendency. . .

C: But some could assume one set better than they could assume another set. Both factors of personality regardless of set was powerful and set regardless of personality was likewise powerful.

C: Of course it isn't a matter of either. Here we all have to judge and evaluate our experiences no matter what gets emphasized, what is preferred, or which is more frequently used. I think a great deal in our society as a puritan background, over development of the conscious and requiring rather rigid adjustment to social norms does tend to develop excessive and impulsive imagery.

C: I still think you're "open to experience" process isn't quite as complete as it should be. I think some natural signs are not as open to social experiences as to non-social experience such as experience in the science areas. I suspect that we might not compete as favorably in some areas as we do in others.

C: I emphasize openness to inner-experience rather than openness to facts and events of the external world. Scientists may be very selective and only open to cold objective facts without admitting to an experience going on within them.

C: Natural phenomenon distinct from social phenomenon.

C: I would like to stick just a minute to this kind of hope and dream that Sid ended with when he said that he thought maybe out of this people could live more creatively and automation would allow them to do more and learn to use themselves more. I think there are a great many kinds of things we can do as maybe ordinary or extraordinary projects which ever you prefer. In classes of creativity, one of the exercises that I suggest is that everyone describe some encounter with his or her physical environment (in past or present). I want to tell just about one woman because this made a difference in her life. One woman whose husband likes to camp but she did not like to camp describes her encounter with the environment on the first camping trip after she was married. They had been married three years and each year she had to endure a camping trip. She wrote pages of all her feelings and what had happened. She started out so negative and told about the things that happened and then gradually she sort of liked the little water fall they found and pretty soon she liked something else. Well, she gets all this out in her writing. This summer one day this woman came in all brown and she said I just wanted to thankyou. You know the course just gave me new life. I said that's good by why and how? She said we just returned from a camping trip and it is the most wonderful thing; my husband is so happy that I enjoyed camping. One thing is putting down this whole matter of encountering with your environment, being free to put it down, free to do anything you want to with it. She got a new perspective without anyone doing anything except providing this opportunity. She got a new perspective on camping. After sharing the experience with other people who also opened themselves up to themselves she realized there's more out here in this world. This is a very intimate thing. I have had 3 of these kinds of episodes this summer of people who in this sharing of personal experience have gained and claimed more creative living.

S: Did you say that these were circlated anonymously when they were circulated?

C: No, their names were there because then they kept on trying to converse with one another and so on. But they didn't have to share with each other. One woman wrote the birth of her baby and she didn't want it circulated. I had a fellow in the Air Force who flew and it turned out later that he had three failing grades in English but he did write the most beautiful thing, on a week-end flight that he had to make on business. He had to go from Tucson to Preston and back and he had a little fly in the cockpit. So he goes from Tucson to Preston identifying and observing and talking about this fly. They got up so high and the fly gets kind of sick and performs dizzly. It is the most beautiful thing you have ever read. His counselor got hold of it because he was up for his masters but had never passed English, and said: I'm going to take this over and tell them they had better give him a grade if he can write this well." This man felt so good about it because he didn't believe he could write and in someway reading the others you see and being free to write anything he wanted opened up this experience to him. I never graded them I just recorded that they had done it. I'm just saying there are many ways in which we can open up things and I'm sure that I could take this process and do much more with it.

S: What we are talking about here has far-reaching implications in the filed of geriatrics.

May I offer one last thought? Jerome Wiesner has pointed out that human resources not used are wasted, but that this is not so for material resources. Dr. Gates of the University of Georgia, in his Creativity News Review, goes even further. He says, that there are times when I feel that when a kid with a 180 I.Q. is born into our society, and lives, for example, as a clerk of some kind with a theoretical lifetime wastage of maybe X years times 90 (i.e. half of his I.Q.), that maybethis unused mental energy goes back into the universe in the form of frustration; and when there are sufficient cases like this our social system will blow up."

Chapter 10

Creation and Instructional Media

Ross L. Mooney
Professor of Education
Ohio State University

S: As work on creative behavior has progressed to date, our main focus of attention has been on the identification of some persons, from among other persons, who could be counted on to make especially productive contributions to the frontier development of certain fields of work, particularly science. We have wanted to separate the behaviors we could call creative from other forms of behavior in order to identify the persons showing the behaviors we have valued, we have then wanted to separate these persons from other persons in order to study them and work with them as a special lot. This approach has been natural for us and possible to us because it fits a general trend of psychological work in which we have been called upon to make similar separations in order to pick some people, from among other people, for their suitability to particular situations, such as the school, the factory, or the office. We have had special situations in mind for the "creatives" and we have tended to focus on them, too, as "separates" to fit these "separated" situations. As we have studied creativity, our focus, then, has tended to be on what separates and not on what is common, on what is particular and not on what is universal.

But, in this workshop, we are confronted with a different context for our thought. We have entered on another game. Entering on the subject of instructional media with the nation in mind, we have entered on the game of education, taken in the broad sense. We have all the schools in mind and all the people, all the curricula and all the teaching processes and possibilities. We are not picking particular people from among other people to deal with them as a separate lot; we are taking all the people, and then picking a particular mode of behavior which we would like to see present and developing in all.

We are dependent, now, on our ability to see creativity as having a base in the lives of everyone such that, through education of suitable sort, each person may develop more fully his creative potential. Able to recognize this base in everyone and to visualize the form of its development, we are then in position to see instructional media as means to the development of people from creative base toward creative goal.

We are in need of three conceptualizations: (1) a view of the species, man, such that we can recognize in each man his in-born creative base; (2) a view of creativity such that we can visualize a valued direction of development of man from his creative base; and (3) a view of instructional media such that we can comprehend and judge these media as means in the educational development of men from their creative base toward the goal of more creativity. The first gives us a base to work from, the second gives us a goal to work toward, and the third gives us means to work with.

I want now to present my thinking with respect to these three conceptualizations.

The Creative Base in Man

For the purpose of conceiving and perceiving a creative base in all men, our studies seeking to sort out the particular qualities of creative people as distinguished from other people have not been a waste. Indeed, they have a crucial value in this connection, and this is our great good fortune. But to get their value for the enterprise we are now launched upon, we are required to make a radical shift in what we take our findings to be pointing to.

We need to take our findings as if they were indicative of basic processes in the operation of the human being. We are seeking revelation of how the human being is organized, by nature, to process his experience of life. We are seeking the in-born, the constitutional, the necessary structure and operation of the human as a phenomenon born within, and operating in union with, the broad structure of nature and the universe, taken as an integral whole.

We are brought to seek realization of how it is that our findings fit in a progressive series of contexts, moving from our observations on the psychological behaviors of a few men ("the creatives") as separated from other men, to the context of the psychological behavior of all men; from this context to the biological context of the human species taken as one life form among all life forms; and from the biological context of all life forms to the context of nature taken as a system of the universe in total operation. We are not at the base of human behavior except as we are able to perceive that base as progressively relevant to the sequence of bases, forming, at last, the basic order of the universe. (Figure 1 presents this series of contexts).

This is an inescapable logic and an inescapable necessity in our thought, for it is the universe which has been and now is the basic context in which life is born; life is the basic context in which man has been and is now being born; man is the basic context in which the individual man has been and is now being born; and the individual man is the basic context in which behaviors of men have been and are now being born. It is a synchronous, simultaneously operating net of contexts, and nothing is basic that does not simultaneously relate to the full net.

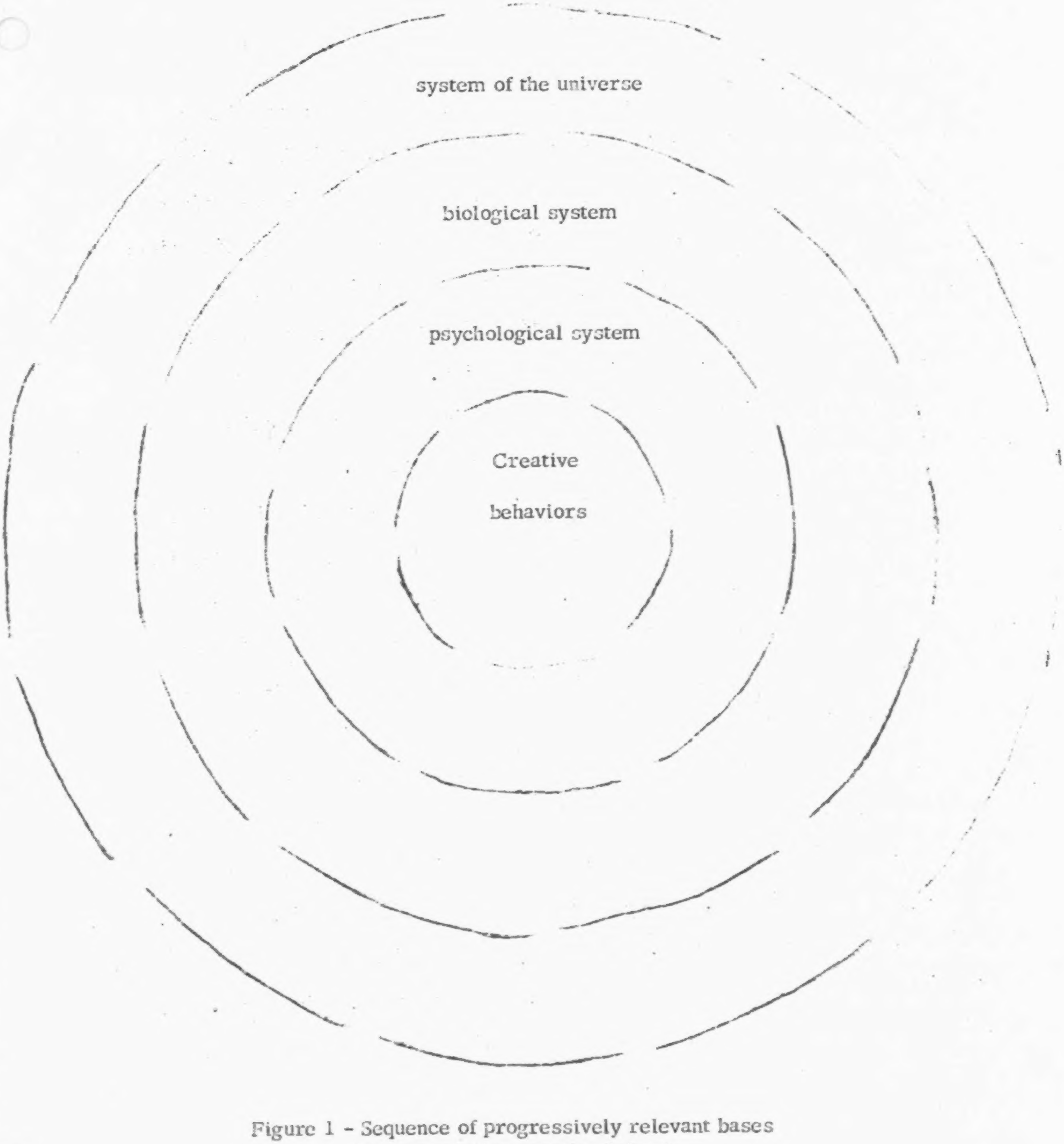

system of the universe
biological system
psychological system
Creative
behaviors

Figure 1 - Sequence of progressively relevant bases for interpreting creative behaviors

Here you are likely to want to protest for this seems much too much to take on, and likely to wind up in a philosophical or metaphysical mumbling which is worthless as science. But I see this basic condition in the universe to be the very ground of science, and I hold myself responsible as a sicentist; this means I hold myself responsible for the internal consistency of my conceptualizations and for their harmonization with the operations of nature as checked-out through observation and experimentation.

Furthermore, I believe that a science which is basic for education is one whichbecomes readily relevant to philosophy and metaphysics. This is the case because education is required to form its scientific conceptualizations in ways which are relevant to "what should be" as well as to "what is." In facing the problem of designing instructional media, for example, we are met with the necessity of designing items which we comprehend as simultaneously relevant to "the given" and "the desired." The media will work only as they fit well to the state of the human creature using them and to the direction of his valued development. The conduct of education constantly requires this form of conceptualization, as do all action programs aimed at the development of men. Furthermore, as scientists, the object of our study is man, and man, factually speaking, is a goal-oriented, value-bearing and necessarily aspiring creature. Our science, to fit this creature, needs formulations which are themselves compositions of the "is" and the"ought to be." As educators, this is our lot, and, impossible as the task may seem, we are required to compose our science so, whether we find it easy or not.

This is the nut I have been trying to crack for a number of years, and this is where I see the great good fortune of those of us who have been working on creative behavior. In studying creative behavior, we have been hovering over the illuminating core, the penetrating, permeating, releasing central insight that reveals the simultaneous composition of the "is" and the "ought to be" in the nature of man, and provides an avenue by which to move progressively from our knowledge of creative behavior, as thus far developed in relation to the qualities of a few men, to the psychology of all men, and then to the biology of all men, all life forms and, finally, to the composition of the universe of nature, taken as a whole.

The initial trick is to move from the study of "creative behavior" and "creatives" to the study of "creation-under-way". Take the same data but relate it to a new ground for its prime meaning. Instead of seeing the data against the ground of distinguishing behavior, i.e., behavior that distinguishes a few men from other men, see the data against the ground of characteristic behavior, i.e. behavior which characterizes any man *when he is operating at the forefront of his capacity making the most complete and efficient use of his make-up as an energy-system resident in a universe of energy-systems all of which operate as participants in a system of creation-under-way.*

Our data is to be seen in the light of what it reveals concerning this system. It is to be taken for its insight into the system of creation-under-way which permeates and orders the behavior of man, the behavior of life, and the behavior of the universe taken as a whole.

Taken this way, the data is then relevant to the successive series of contexts, psychological, biological and universal, in which man exists and shapes his life. Taken thus, the data also becomes relevant to what man *is*, i.e. a system of creation-under-way, and relevant also to what man *is to become*, i.e. an ever more harmoniously relevant participant in creation-under-way.

Man's basic nature then becomes visibly relevant to his basic destiny; the "is" and the "ought to be" are joined in one realization.

With creative base in the "is" and creative goal in the "ought to be," we also have a prospective way of seeing instructional media as mediating between base and goal. We have conceptual harness for our present enterprise, and for educational enterprises, generally. We have, in addition, a distinctive bonus in that we have a way to see our research as basic research, basic in the sense that it relates to the basic nature of man.

This is the conception under which I have been operating with increasing awareness since 1953. In a study of creative people, made at that time, it came clear to me that these men were seeking to cooperate with a system they took to be given to them by their natures. As they were becoming creatively engaged, they were seeking to use their conscious minds and conscious efforts to secure maximum operation of their psychic systems, focused toward an output which would be a product of their total engagement as experiencing creatures. They were not trying to be separate or different from other people; this was nowhere in the forefront of their consciousness as they entered on their own creative production; what they were trying to do was to release themselves for their most complete involvement. They sought the center of their generating natures and they held, with confidence and persistence, to the way their internal systems seemed to them to be built to go. With repeated experience in consciously undertaking to collaborate with this system, they developed sophistication as to what they could do, through conscious effort, to aid and abet the occurrence of fullsome creation. They learned what to invite and what to fend off, what to insist upon and what to leave free, what to trust and what to doubt. They learned from their failures as well as their successes and they learned something of the necessities of their inherent system. They evolved a discipline accordingly.

Their sometimes bizarre behaviors when cultivating a creative occurrence were due, not to their desire to be idiosyncratic or separate or different, but to their intense desire to honor what they thought to be necessary to the freeing of their generating system. In so far as they were doing things differently from the common run of men, they were doing so only because they were seeking the concentration and distillation of action in their own systems. Rather than being peculiar specimens of men, they were the truest specimens of men, truest in the sense that they heeded most honestly, most directly, and fully for the realization of their natures as men. They were to be seen at the heart of mankind and not at the periphery. They were trying to reveal to me something I should know about the elemental nature of man.

So I looked and I listened; I worked over the stuff and I meditated; I invited the release of myself from the intense necessity to know what these people were trying to teach me about the elemental nature of man. Then the time came for my own integrating and revealing insight. Those of you who know my writings know of my efforts, then, to put the form I had realized into a conceptual order (Mooney, 1953, 1954, 1956). Since then I have come to varied editions of the same realizations, realized anew when facing other contexts of life: biological forms in nature (Mooney, 1956, 1963); psychological forms as focused in the perception laboratory (Mooney, 1951a, 1951b, 1956), in communications (Mooney, 1961) in counseling (Mooney, 1960), in teaching (Mooney, 1955, 1963), in the production of art (Mooney, 1955, 1961); anthropological and sociological forms as focused in the founding of societies and social institutions (Mooney, 1956, 1963); administrative forms as focused in the operation of educational and research agencies (Mooney, 1957, 1963, 1963, 1964); intellectual forms as focused in conceptualizations of inquiry and research, and forms of education suitable to the nurturance of research men (Mooney, 1951, 1957, 1963a, 1963b, 1964).

The latest and most comprehensive formulation to be published was a paper on "Creation and Teaching," appearing in 1963. During 1962-63, I turned to poetic cultivation and reached another level of knowing, the most comprehensive, penetrating and satisfying to date, though unpublishable since thought in poetic form is not publishable as serious conceptual discourse in our circles of inquiry (Mooney, 1963 , 1963). This past year, 1963-64, I served in Israel as consultant to their research agency in education to help give shape to the creative efforts of that creative and vigorous nation. I had learned, by this time, to take a nation (or any other social institution) as if it were a creative medium, and to aid in designing a way for educational planning which would accept that projection and build systematically upon it. I did the same with respect to the designing of programs for gifted children from culturally deprived homes, and the designing of a research report to interpret fascinating data on why children from culturally deprived homes are not able to learn well in school, and what to do so that they might come to learn better. The key idea here was that these children had not had a way of recognizing or cultivating themselves as creative creatures; teaching them involved arranging circumstances so that they would come to realize themselves so.

I cannot, of course, take you over this complex ground, covering more than a decade, for we are all eager to get to the implications of our thought forms, whatever they are, for instructional media. I have had to take recourse here, to mapping the trail leading me to here, and, otherwise, to merely suggest the shape of the concept which has repeatedly come to be productive.

The concept was most succinctly worded in the following quotation where I was summarizing on the essential conditions for the existence of an organism:

> Worded in a sentence, the elementary conditions for the existence (life) of an organism are that it operates as a system (1) open to its environment (2) integral of its being, (3) in transactional give and take with its environment, (4) selectively making fresh fittings (adaptations, creations). (Mooney, 1963)

Diagrammed, this system is symbolized in Figure 2. The circle is to suggest an integral entity. The breaks in the circle are to suggest the openness of the entity. The infinity sign is to suggest transactions continuously going on between the entity and its surroundings, i.e. inputs coming in and outputs going out, connected as sequentially relevant in sustaining the system. The plus, minus, and equals signs at both ends of the infinity sign are to suggest the selections of some things from among other things for inclusion, exclusion, or toleration in the transactional operation, forming selective fittings, progressively evoling creations. Creation goes on as the system operates.

Creation increases within a given system with increasing openness, increasing integration, increasing transactional functioning, and increasing selectivity of fittings, all these increases operating in mutual support of one another as they occur.

This conception accepts the base of man as a creative base, the goal of man as that of an increasingly creative creature, participant in creation-under-way; and it provides a way to try to think out how one would organize circumstances and action to aid in the development of men from creative base toward creative goal.

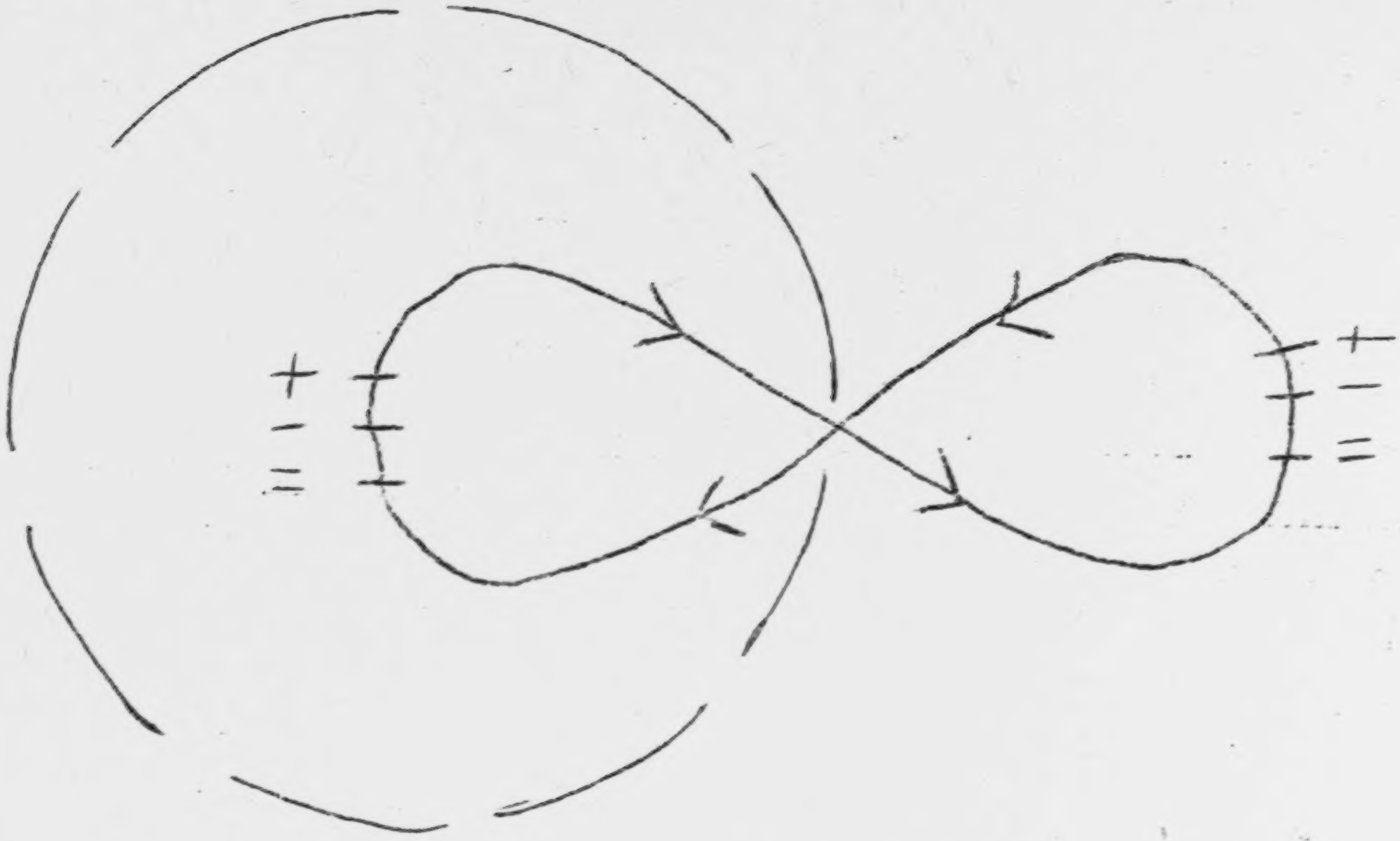


Figure 2 - Diagram of a creative system

1. The circle is to suggest an entity which operates as an integral and an integrating system.

2. The breaks in the circle are to suggest the openness of the entity for transactional give and take with the environment.

3. The arrowed infinity sign is to suggest the progressively sequential transactions which go on between the entity and its environment.

4. The plus, minus, and equals signs at both ends of the infinity sign are to suggest the selective fittings which go on at both ends of the operation, thereby creating new states in the system.

The whole is to suggest the manner in which creative systems are composed to operate, i.e., as integral, open, transacting, progressively creative systems.

7

It remains for us now to use the concept for its utility in approaching the problem of designing instructional media.

Our first task is to visualize our goals in terms which relate what we want in the behavior of people to what we want in the functioning of instructional media.

The Creative Goal

1. We want people to mature as creative creatures, able to participate ever more fully in creation-under-way. This means to increase, synchronously, in their openness to experience, their integration of experience, their transactional relations with their world, and their selective fittings to compose increasingly inclusive creations. This is the central goal.

2. To thus mature, people need to be able to experience themselves as creative creatures and to experience their world as a place where creation is under way.

3. To be able to experience themselves as creative creatures, they need to create products of their own and to realize themselves as instruments to such creation.

4. To be able to experience their world as a place where creation is under way, they need to be able to see their world, in its varied forms and contexts, as a creatively operating phenomenon. They need to see humans, life, and the universe as creative.

5. Experiencing themselves and their world as creatively operating phenomena, they need to integrate their own creation with creation in the world, and to participate increasingly in creation-under-way. The path of maturation is down the road of this increasing participation.

6. During the experience of realizing themselves and their world as creative, and their committing themselves to increasing creation, they need the support of other people who can help them in coming to such realizations and commitments.

7. Education is the name for making arrangements by which people can help one another in achieving these realizations and commitments.

8. Educators are people who are given particular responsibilty by a given society for seeing that people are given this kind of help.

9. Schools are media by which educators try to give such help.

10. Schools are media for communicating creation.

11. Teaching is creative communication.

12. Learning is creative realization.

13. Knowledge is a created form to be used in further creation.

14. Curricula are designs for aiding learners to realize creation in themselves and in various contexts of their world (physical, social, psychological, biological, vocational, etc.) and to engage themselves in creating those contexts.

Instructional media are means used by teachers to help students achieve these realizations and commitments.

These statements visualize the main goal of our work and the relevance of instructional media to the attainment of that goal.

Let us focus, now , in more detail on instructional media, expanding on the statements given.

Instructional Media

1. "We want people to mature as creative creatures, able to participate ever more fully in creation-under-way. This means to increase, synchronously, in their openness to experience, their integration of experience, their transactional relations with their world, and their selective fittings to compose increasingly inclusive creations."

Maturation implies sequentially progressive inclusiveness. Instructional media should invite and fit this development. They should fit to the individual student at his given place of development and then (1) open avenues to fresh experience, (2) allow the student to integrate the significance of the experience in his own system, (3) invite and challenge further involvement in the lines opened up, and (4) invite, challenge and honor creations by the student in which he expressively forms his own construction of his expanding experience. Moving forward on his own creations, he can consolidate his growth, and have a base for further growth as he successively repeats the operation.

2. "To thus mature, people need to be able to experience themselves as creative creatures and to experience their world as a place where creation is under way."

The experiencing of oneself as a creative creature and the experiencing of the world as a place where creation is under way requires of a student that he realize, on the one hand, the process of creation going on during his own creating, and, on the other hand, the processes of creation going on in his world. Instructional media which help in these realizations need turn the attention of the student inward to sense the engagement of his own mind and being as he works on his own creations, and outward to sense the operations of the world in creating new forms. The media need to support the effort of the student to focus his attention "as if on the inside" of creative forming.

3. "To be able to experience themselves as creative creatures, they need to create products of their own and to realize themselves as instruments to such creation."

Realizing the process of creation going on in oneself leads to the recognition of oneself as an instrument of creation. One comes to identify himself, to accept himself, and to know himself as such a creature. Instructional media need to aid the student in coming to this identification, acceptance, and knowledge.

4. "To be able to experience their world as a place where creation is under way, they need to be able to see their world, in its varied forms and contexts, as a creatively operating phenomenon. They need to see humans, life and the universe as creative."

Realizing the processes of creation going on in the world leads to the recognition of forms in the world which are operating as creative systems. Recognizing these forms in the context of man-creating, life-creating, and the universe-creating, leads to a realization of a common processual form by which the world as an integral system, achieves creation-under-way. Instructional media need to reveal (1) man creating in the way his body works, his mind works, and his society works; (2) the way life-forms work in giving birth, in achieving growth, and in relating to each other to form mutually supporting creative systems; (3) the way the universe works in its physical, chemical and astronomical operations, and the way in which the universe operates as an harmonious whole, inclusive of the physical, life and human forms.

5. "Experiencing themselves and their world as creatively operating phenomena, they need to integrate their own creation with creation in their world, and to participate increasingly in creation-under-way. The path of maturation is down the road of increasing participation."

One's own creation becomes significant, nourishing and fulfilling as it comes to be fulfilling, also, for creation in the world. The union of self and world in creating may form as one becomes involved in any one or more of several engagements, e.g. with other humans in professional or personal life, with art media, with biologial life, with economic production, with social institutions, with ideational forms. Instructional media need to give the student the chance to test out, locate, and become engaged with those forms of creation which are most responsive to his own particular mode of forming so that he may find his most promising creative involvement(s). Released into his most fulfilling activity, he can mature most readily by extension of his experience from this center (or these centers) of growth. Instructional media should aid him in this extension, unfolding a way to move out from his center(s) of greatest security and vitality to include more and more of the world as realized ground for his participation in creation-under-way.

6. "During the experience of realizing themselves and their world as creative, and their committing themselves to increasing creation, they need the support of other people who can help them in coming to such realizations and commitments."

The human race is such that people learn from people how to approach their learning. Children learn from adults not only what to pay attention to but also how to compose themselves while giving attention. If youth are to compose themselves as creative creatures, and mature in this basic disposition, they need the company of adults who also compose themselves in this fashion. Instructional media need to be so formed that they can serve adults in becoming effective companions of this sort. The young may then more readily have available to them models of psychic constellation into which they can imaginatively put themselves, acting as if they, too, were forming their experience in the way their companions do, thus to have the help of others in realizing creation-under-way.

7. "Education is the name for making arrangements by which people can help one another in achieving these realizations and commitments."

This is education's function. By nature, the human species is a creative phenomenon; so is the world. Adults in the species need induct their young into effective ways of operating creative systems. "Education" is the name for this function. Since this way of viewing education is not common, instructional media are needed to help people realize this conception and to organize their educative acts accordingly.

8. "Educators are people who are given particular responsibility by a given society for seeing that people are given this kind of help."

Educators form the profession in this field. They will be the users of instructional media; they will be the exemplars for the young. How well they comprehend and embody education as a creative phenomenon is crucial. Instructional media are needed to help people in the profession form their professional conceptions and acts as relevant to a creative operation.

C: You described to education the role of carrying out societies. It seems to me that unless you are an idealist of philosophy you could get into some problem here. That is all you have to talk about are biotic communities or something which make out in a certain setting. You know you have to look at the community almost as you have looked at this small organism.

S: You know the community has to operate as a creative system. Now then it can operate relatively harmonously with relationship to its implicit necessities or inharmonously.

C: Yes, but a community is different in the degree of creativeness.

S: Sure they do just like people do, but if I'm not creative, I'm dead. I mean way down at the base bottom there is something to build with and something which you can pronounce into a progressive series, a series of efficiency, more or less efficiency in the operation of the system. This would produce different societies in individuals of different capacity to show form because there are different grades of context in realizing this.

C: That reminds me that there is a degree of idealism that has to creep in because such communities can die off, but in this process I imagine individuals who are not trying out this base process adequately enough.

S: Well, I think I am reacting a little bit against this but we arrive at the same place, but I don't think of myself as an idealist at all. I think of myself as a hard-headed realist.

C: If we don't act as somewhat in the idealist model, you are talking about a model here, but react to that then I see a problem here of how a community regenerates itself and how teachers can change them.

C: Well, this is what the Peace Corps is trying to do. Trying to give a shot in the arm, a self-renewing feature to a community which is in many ways progressing, not changing, not meeting some of the problems. We are trying to help them start using their own resources, and I think we are playing the same game when we think of students. How can we visualize the outside world and do some kind of things to have the person draw upon their own resources?

C: You almost think of the teacher as an anthropologist in a sense that he is somewhat associated from the cultural process, he has to be a participant observer or a change agent, and be at the mercy of the system which may be degenerating, and I don't know if that's possible.

C: Would it seem that the focus part, the visible part is a kind of a scatter in which you don't partake of the whole culture at once. You're mechanism is interacting with parts of the culture.

S: These are also systems in the sense.

C: Yes, for instance the role is a very important thing.

C: Is that where you slip the culture in?

C: Organizations have a life span and may die and so how can you keep your organization so that it doesn't go through the dying span? The same thing is true in culture. For instance I have often said that some of the youngest people I have met on our campus are not the students, they are a few of the faculty, and I also find some of the faculty are some of the oldest ones.

C: One of the questions that we have to ask in discussing an open system though in actual strategy is to ascertain the degree to which it is open and then what can be done to open it further. I mean we have a model when we talk about it as an open system in reality. Many of them are excessively closed so the problem as I can see it is the implication in the work to provide the opportunity for this system to be open.

S: 9. "Schools are media by which educators try to give such help."

A school system is to be taken as a creative system, (1) open to society to receive what is relevant to its functioning (students, teachers, money, etc.) and to give to society what is relevant to society's functioning (persons able to be productive in home, jobs, civic life, etc.); (2) integral in its operations in order to effectively transform its input from society into the output society is to get; (3) transactional in its operations in order to maintain, through time and change, the relevance and vitality of its give and take with society, and transactional, as well, in its internal operations as sub-systems within it give and take with one another in their integral work of transforming input to output; (4) creative in its operations in order to fit what it does to the native operations of its personnel as basically creative creatures, and, in order, also, to achieve its elemental purpose which is to teach people how to nurture their own evolving creative capacity. Those who operate within the school system in the roles of superintendent, principal, supervisor, teacher, student, etc. are to take their roles, in turn, as creative roles. Thus conceived and operated, a school system can be a creative system, having a discipline of that order. Instructional media are needed to portray educational institutions as forms to be taken as creative. Professional workers need media specifically relevant to their roles, in the concrete context.

10. "Schools are media for communicating creation."

A communication system is itself a creative medium when operating between persons. The communicative process needs to be comprehended and operated as a creative system, fulfilling the requirements of such systems. Instructional media are needed to present communication in this light and to reveal the school as an agency primarily engaged in this process.

11. "Teaching is creative communication."

Teaching, as the central activity of adults in the educative process, needs to be realized as a discipline based on the operation of a creative communication system. The teacher needs to realize himself as a creative communicator, inducing, in return, creative communication from his students. He needs instructional media which fit to this necessity. In so far as he has not yet realized his discipline in this fashion, he needs instructional media to help him realize it so.

12. "Learning is creative realization."

Even as teaching, for the teacher, is a discipline operating as a creative system, so also is learning, for the student. The student's instrument for learning,i.e. his "mind," is so formed as to operate most efficiently when it synchronously opens, integrates, transacts, and creates. The student can learn best when experiencing the creation of his own meanings, formed from his own experience by the operation of his own mind. He learns to learn, i.e., to be his own teacher, as he successively experiences the operation of his own mind in giving creative form to his experience. He has internalized the teacher and the teaching operation. Instructional media are needed to present learning as this kind of process so that teachers can comprehend it so, and so that students may be more quickly led to comprehend it so.

13. "Knowledge is a created form to be used in further creation."

"Knowledge" is the name we give to forms of meaning which have already been created in the knower and are available as means by which to create still further knowings. Knowledge is vital to a learner in proportion as it serves the learner in his on-going creation of meaning. It is dead when unused or unusable. It is unusable when it is not his own. A "subject" taken as an ordering of knowledge by adults, is not knowledge in the student until the student can use it in his own creative work. It is not a "subject" for the learner until he can subject it to his own creative use. As students are able to progress in realizing themselves as creators of knowledge, they are more likely to make use of knowledge created by others. The function and use of knowledge need to be understood so, and instructional media are needed which will present it in this light, both for the teachers and for the students.

14. "Curricula are designs for aiding learners to realize creation in themselves and in various contexts of their world (physical, social, psychological, biological, vocational, etc.) and to engage themselves in creating in those contexts."

Curricula are the plans we make to invite the student's creative realization and engagement. They include the varied contexts in which the student may become creatively involved. If each context reveals creation-under-way, then the varied contexts have an integration for the student. Moving from a class in physics to a class in art, to a class in sociology, to a class in economics, etc., he can sense a common core, a common realization, a common question. His subjects have a cumulative, expanding and penetrating impact while he wakes up to himself and his total world as an orderly arrangement in which he can find security, challenge, and growth. Instructional media are needed which reveal each context in this way, and a curriculum is needed which puts the contexts into an arrangement to maximize their synchronous and cumulative effect on the learner. In addition, instructional media are needed which present this strategy of curriculum building to educators.

The discussion, to this point, may be sufficient to convey the general impact of this approach. What, now, does the approach imply for the designing of relevant research and development projects?

Implications for Projects

The foregoing section suggests a number of projects, of which these are a few:

1. Test the hypothesis that the basic forms in each major subject-matter area may be conceived as creative systems. Consider as basic forms such as the following: in the physical sciences, the atom, the molecule, the electromagnetic system, the solar system; in the biological sciences, the cell, the organ, the organism, the systems of birth, growth, evolution; in psychology, the systems of perception, learning, communication, maturation; in sociology and anthropology, the social institution, the social role, the evolution of societies; in the arts and humanities, the systems for the production of art forms, and the forms of the products then produced. Check with specialists in these fields on the adequacy and utility of such conceptions.

2. Test the hypothesis that given subjects may be organized as revelations of creation-under-way; for example,

(a) Sketch out history as a revelation of man confronting creation and undertaking creation, done so as to provide guide lines to what serves social creation best and what does not.

C: You were more interested in predicting history than writing history or reading it.

S: As it had been done yes, but it would be a highly creative job to recompose American history as the history of people in the processes of creation.

(b) Sketch out science as a revelation of the processes by which man creates when he is seeking comprehension of the way nature creates, done so as to show the scientist creating science as well as to show nature as a creatively forming system;

(c) Sketch out the arts and the humanities as a revelation of the processes by which man creates when he is seeking comprehension and development of his own emergent meaning, done so as to show the artist creating art as well as to show the creative form of the products produced.

Check with specialists in these fields on the adequacy and utility of courses of study, so composed.

3. Critically survey popular courses of study at a given academic level, say the twelfth grade, to discover the degree to which and the way in which creation is recognized as an element in the composition of man and nature. Appraise with respect to the envisioned necessity.

4. Search through audio-visual materials currently available to locate those items of most value in presenting man or nature as creative systems. Do the same with respect to books and authors. Prepare an annotated listing useful to teachers who want, now, to use such materials.

5. With curriculum-builders in mind, present a statement of curriculum building as a process of planning experiences for students which lead the students into a realization of, and involvement in, creation-under-way in themselves and in the world. Use the statement to locate responsive persons who might be willing to participate in furtherwork to build curricula for this purpose.

6. Critically survey recent nationally prominent developments in curriculum building in the natural sciences, mathematics and English to appraise their affinity for "a creative approach" as here conceived.

7. Review recent work (e.g. Bruner, et. al) on "the structure of knowledge." Relate to a conception of knowledge as a created form for use in further creation.

8. Present a conception of a student's system for learning as a creative system. Use to compare with currently popular conceptions of learning. Prepare hypotheses for test in experimental situations where students succeed in learning and fail in learning, comparing the fecundity of hypotheses as derived from the creative conception and other conceptions.

9. Develop a conception of what takes place as a student develops in his ability to become his own teacher. Using case study, follow the development of students on this dimension.

10. Investigate the phenomenon of "experiencing oneself creating;" turn to "creatives" for help on this question; prepare devices for locating youth who are relatively developed in this capacity; relate to their motivation for undertaking creative work.

11. Investigate the capacity of "creatives" "to focus attention 'as if on the inside' of creative forming"; learning how to recognize this phenomenon; look for it in students as they become involved in creating their own products; expand on implications for learning theory.

12. Conceive maturation as a progressive expansion in the operation of a creative system; test against the maturation of "creatives" in respect to their development as creative producers; test also against conceptions of progress in therapy, and the maturation of "self-actualizers"; relate to the maturation of students as learners, and test against case histories of students identifiable as maturing in learning,

13. Conceive a communication system as a creative system; compare with other common conceptions of communication systems; design projects to research teaching as creative communication.

14. Present a conception of a school system as a creative system, existent in super-systems of the same order and composed of sub-systems of the same order. Outline a system of questions aimed at comprehending the operation of a school system as such a system, applying the questions to the sub-systems as well as to the school as a whole. Test the system of inquiry by applying to concrete school systems, asking the question, which of these is functioning most fully as a creative system.

15. Review the work of those who have undertaken to describe "the creative teacher." Seek a synthesis, using the concepts here implied. Form systematic inquiries, designed to help students, teachers and administrators, evaluate teachers as creative. Test these inquiries in practical use.

16. Review the work of those who have done recent research on creative behavior and "creatives." Seek a synthesis, using the concepts here implied. Form systematic inquiries, designed to locate more creative students. Use to appraise instruments thus far developed to locate such students indicating new instruments which are needed to round out the system. Suggest relevant projects for the development of such instruments.

17. Using instruments available for identifying the more creative teachers and the more creative students, test the hypothesis that "creative students appear where creative teachers appear."

This listing may be enough to suggest some of the kinds of work which need undertaking.

Whatever the work undertaken, it will be critically influenced by the policies andpractices which surround its sponsoring and operation. Following are some observations relevant to development in this area.

1. Advantage should be taken of the work already done on creative behavior and "creatives." The main problem here is to synthesize the concepts and the data, while using them to focus more directly on their meaning for the conduct of education. Two shifts are necessary, one toward synthesis, and the other toward education. A considerable transition in frame of reference is involved. This workshop is an auspicious beginning. It might well be followed by a project in which we, and others, are asked to seek synthesis and to provide a well thought out basis for a long range and comprehensive attack on the problem of education, taking the creative approach.

2. Sponsors of projects in this area will need to accept the fact that the "research" projects themselves, and the "development" projects themselves, will need to be taken as creative enterprises in their own right. Those who participate in these programs will need to experience themselves, their work, and their world as creative while they are engaged in promoting the creativity of others. There is no way to cheat in this creative game. The methods have to be creative if the goals to be achieved are creative. This means much leeway needs be given to project workers to follow their own leads and to shift course as their own creative insights occur. Rarely will it be possible in this area to present neat, pre-formed, projects with a given kind of result guaranteed in advance. Sponsors will be needed who can accept this condition.

3. Significant progress in this area cannot be made apart from much work at the conceptual level. We are involved in basic research and basic research requires advanced conceptualization, all the more so when it is used as ground for the conduct of action programs. Time to think is absolutely essential; time to talk and work with thinkers is absolutely essential. Sponsors are not often equipped to give support for this kind of time. They are equipped with procedures and habits of work to give their support to limited and defined data-gathering projects but not to give their support to work which centers on the organization of the implications for a changed conceptual approach to the whole field. Yet the major advances in science are those connected with break-throughs into fresh conceptualizations. Such break-throughs are requisite to fundamental progress in any area, and particularly important in the area of education at this time. We stand a chance of providing such a break-through if given the time and the resources to lay out what research and development comes to be when education is taken as a creative enterprise. We

will need sponsors who understand this situation and who are willing to give support to the necessary conceptualizing work as basic to the design of all the rest.

4. We will not get far except as we are able to get the profession of education to comprehend what we take ourselves to comprehend as basic. The first efforts should probably be directed toward the audience of professional education. Where response comes, we can locate participants who would be good potential resources for further work in this area.

5. A balanced development is needed. Instructional media will not be contributors to the development of creative behavior except as teachers use them so, supported by a curriculum design and a design for administration of the schools which reinforces the teachers and students in their accomplishment. In turn, the school as a whole needs the support of its community in seeking the creative development of its young. The creative development of the young is more than a matter of methodology in the way content is handled; it is a matter of the content itself. Students need to evolve their methodology in pursuit of the realization of content. Teachers, also, need to evolve their methodology in pursuits of a realization of themselves and their world as substantively creative. So, also for administrators and for the supporting public. Projects are therefore needed which deal with content as well as method, with the substance of reality as well as with the way reality is taken for learning. Projects need also to face in the directions of all the participating groups, the students, the teachers, the administrators, and the public.

6. Our aim is more than creative behaviors; it is creative persons in a world taken by them as a context of creation which supports them in becoming increasingly fulfilled as creative creatures. Without the big sustaining view, the accomplishment in little ways will not be sustained. Our goal is to help evolve the young so that they can live out their lives in a continuing search for, and expanding realization of, creation-under-way.

7. Much more is at stake than our personal whims and desires. Early America was formed by circumstance into a very favorable ground for the cultivation of a creative people. It was not necessary in the pioneering and formative period of our national life to be deliberately conscious of creativity; we were called upon to exercise creativeness at every turn, and the circumstances were such as to reward the individual American for his creativeness when he exercised it. We have come to a time, however, when our society is now shaped primarily by the conscious. decisions of men to give to our life and work a given order. Complex systems are operative which prevent the individual American from readily practicing his creative approach to the world. He now needs to be fully conscious of his need to be a creative creature in order to take the conscious steps which can help guarantee that he be able to live his life so. What came naturally and unconsciously to him in the earlier time comes now only with conscious intent to forge his life in a creative way. Education has the job of bringing the nation to consciousness of creativeness as a prime necessity in the survival of man. Our responsibility, as men conscious of the importance of creativity , is to open a way by which education can do what it must.

Chapter 11

Instructional Media for Creativity in the Arts

Kenneth R. Beittel
Professor of Art Education
The Pennsylvania State University

S: We do not know enough to have firm theories about learning and creativity in art, but enough, I feel, to make conjecture highly profitable and challenging. Philosophers have and will continue to chide us in educational research for our tendency to confound "is" and "ought," when we speak of knowledge about something and then project what "ought" to be done. Acknowledging that prescriptions are not in the scientific universe of discourse, however, we are still left with the job of rational planning toward culturally held values, and, possibly, some biological "universals." Thompson (1961), an anthropologist, produces the following relevant Big Fuzzy (my name for a class of broad, often metaphysical, statements that ring "true"):

> "The isolated community, including man, still tends to evolve in the direction of the ultimate biological goal of all organisms, namely, self-actualization. Ordinarily, through processes of mutual aid, correlativity, symbiosis, accomodation, and competition, each component species in the total arrangement continues actively to maneuver itself into a favorable niche in the life-action supersystem."

The image of harmony and fulfillment projected by such a statement corresponds to a utopian myth endorsed by us as modern scientific men in our moments of optimism. Education, under perennial criticism, is still the most likely place for our gaze to fall in search of a route toward such ultimate objectives. It is in this spirit, with some trepidation, if not hesitation, that I offer my comments and reveal their bases in our studies.

Having been so vaguely general up to here, I am now going to be specifically abstract, to coin a paradox, and present the unintegrated stuff for a theory of creative learning in art as it seems to emerge from studies just completed by Burkhart and me (1962-4) and several doctoral and postdoctoral co-workers. This will become a base, with certain other ingredients, for the suggestions I will try to make; and I will try to present the evidence on which the base is laid. You will notice that my words and ideas are not original and, although I won't blame this on others not always free from ambiguities. I am happy that Carl Rogers is here, for some of our findings seem to corroborate his "tentative theory" of creativity first advanced in 1954, although we did not consciously set out to confirm or refute any existing theories.

In true scientific fashion, if you will permit some irony, the assumptions under which we labored were clear to us only after our studies. Further, one of our most important findings, that of a coherent creative strategy not matching classic problem-solving models, was completely unexpected until near the end of our first experiment. I know you will abhor the name we gave it, the Divergent strategy, since the word divergent has broader and different meaning in the creativity literature. If a better name occurs to any of you, we are open to suggestions.

In discussing instructional media for creativity in the arts I get a vision of a lone character sitting outside there on the edge of the field with just some old burnt stick to work with. That's the base or beginning. The things that are important are the individual, then the learner, after that the environment, and then, I'm afraid, the teacher, as far as my knowledge goes. Sometimes, as far as my knowledge goes, the teacher messes up the works.

C: Then are you really saying that the audio visual aids would be the environment, in a way?

S: I think that what we are really trying to do is in a sense to regulate the environment, and to do thispartially by setting a frame against which dynamics can be observed, and that this has helped students to learn in ways that were amazing to them also.

C: In your remark about Finn's discussion on media technology what intended to counterpose your position to his?

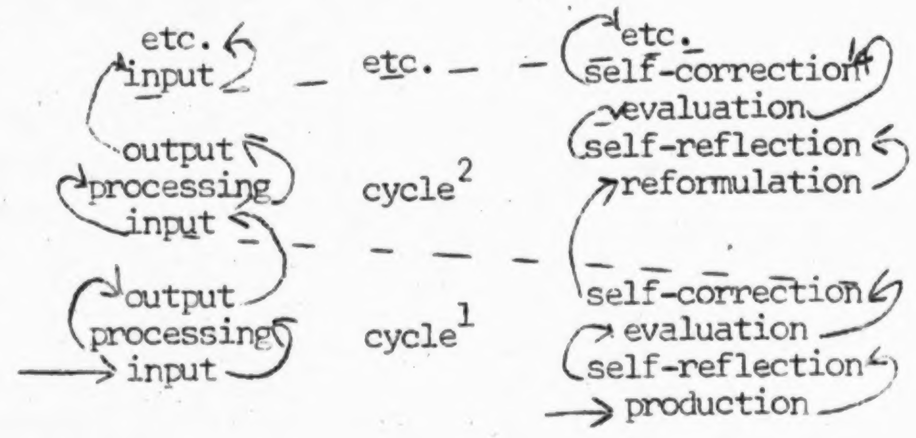
S: I didn't mean to say that all the vast technology available is not potentially useful. I don't know how to use a lot of them in art, and those I have used have excited my imagination, I think, more than my students, because I have gotten creative in their use. The results I have gotten by and large, as I said in the paper, are more spectacular than basic. A simple, good still camera has been most useful to date.

A Theory of Creative Learning in Art

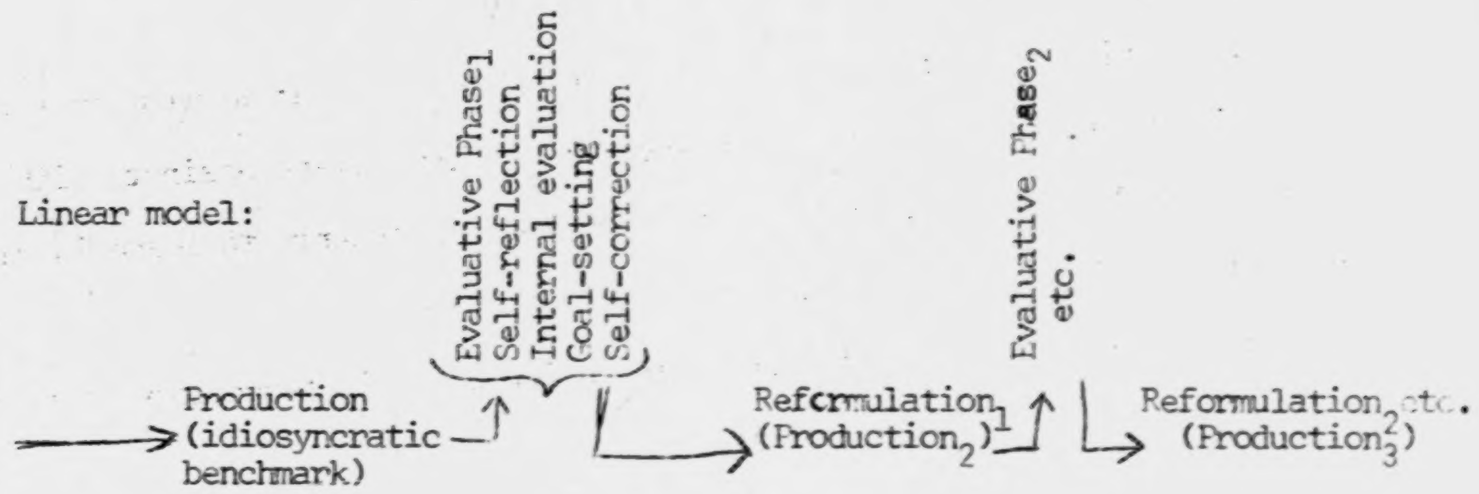
1. The Reformulative Base to Creative Learning

A. Models of Reformulative Learning:

Spiral Models:


etc.
input
output
processing
input
output
processing
input
etc.
cycle^2
cycle^1
etc.
self-correction
evaluation
self-reflection
reformulation
self-correction
evaluation
self-reflection
production

Linear model:


Production
(idiosyncratic benchmark)
Evaluative Phase$_1$
Self-reflection
Internal evaluation
Goal-setting
Self-correction
Reformulation$_1$
(Production$_2$)
Evaluative Phase$_2$
etc.
Reformulation$_2$ etc.
(Production$_3$)

B. Assumptions Concerning Art Activity, as Representing Creative Learning"

1. In producing a work of art, the maker, sophisticated or naive, is enclosed in a dialogue between the self (perceptions, concepts, life history, goals, etc.) and the object (medium, unpredictable and irreversible emergence of parts and the whole through process).
2. This dialogue is a private affair, operating through the perception and history of the doer. It is hard to understand "from the outside."
3. The evaluative phase can be separated out from the activity phase. As such, the evaluative phase is open to educational influence, but only insofar as that influence operates in harmony with or in extension from the base of the doer.
4. A new and important kind of measurement of creative learning is that of the increased power or health of one's strategy. Such judgments I will call intra-individual or internal judgments. They are seen over a series of reformulations within one individual's works through:

(a) The increased complexity of the strategy (greater number and clarity of parts) as compared to a beginning benchmark.

(b) The flexible but emerging and evident dominance-subordinance relationships of these parts to each other (structural hierarchy roughly maintained across at least two reformulations).

(c) Directionality of an apparently progressive nature across reformulations.

(d) Increased uniqueness of parts in combination (tensional complexity through inclusion of parts of greatly differing dimensions)

I must confess that we have measured only the first of these adequately to date.

5. In addition to the "dynamic" and "system enclosed" measurement above, external or comparative judgments cutting across individuals are an essential and different perspective on creative learning. The old fashioned global or gestalt aesthetic judgment as performed by expert judges is still sensitive to experimental change. We have also experimented with more specifically descriptive differential criteria which can be applied to art works dispassionately and can be assigned to essentially non-overlapping domain (Bernheim, 1964). In applying them to works of art, however, we suffer from Humpty-Dumptyism, or how to put them together again once we have them. And with our healthier gestalt judgments (no matter how much the psychologist may shudder at their relativity) we have a further problem in the way judge bias becomes a factor, even within a reliable agreement range (see Beittel, 1963). In our most recent judgments, for example, expert judges have been classified according to their own art strategies, and these have been shown to be a significant source of variance in their aesthetic judgments. What I have called internal and external, or intra-individual and comparative, judgements, can yield significant

findings which are often opposed to each other. In short, we have plenty to do on the criterion problem.

C: What set of instructions did you give the students in your experiments?

S: We told them that the study was part of their schedule but not part of their graded work. We set a standard time to work with them, and told them they would work for four weeks with four 75 minute studio periods. The instructions were that this was a self-learning experiment and that we would provide the materials and stage the environment. They were, in a sense to find their own direction and we told them we thought they would find intrinsic motivation in their own learning. We said we would vary conditions slightly for some of them, but not the major working conditions, one of which was that we would not do anything during the studio period. In other words, we gave mostly procedural instructions and tried to establish the intended climate for the study.

Let me recap a bit here what I think we did. We kept the environment relatively still so that the individual's movement could be seen, and we provided him feedback which we thought or hoped would regulate his ongoing directionality. We interacted minimally with him, even when we were there personally in the evaluative session. Of course, there were things to be shared, like enthusiasm. If somebody was enthusiastic, we reacted "congruently," as I suppose Rogers would call it. We smiled if they smiled, etc. We were genuinely interested.

An interesting side effect was discovered when we asked the 48 juniors questions in interviews at the close of the experiment. They mentioned how much they felt they learned and how different their work was from their instructed studios. We then asked them how they thought of us when we were in the interactive setting. They never thought of us as teachers but as researchers, which somehow meant that they could learn more. Now this was a curious switch that we have to contend with. The teachers they were working with and the art studios they worked in were certainly not rigid. There is a drive for excellence, but there's more leeway than in most academic courses.

C. Environment for Reformulative Activity

1. Relatively invariant setting or "frame": e.g., time schedule, same medium, same stimulus, procedural constants (such as an evaluation form)
2. Value Neutral Field: absence of external approval-disapproval, no grades given, "anything goes" within the contraints of the frame, "congruence" (acting "naturally"), accepting the doer as of "unconditional worth", entertaining all products, self-learning seen as intrinsically rewarding (several of these terms are borrowed from Rogers, 1963).

II. Specific Evaluative Conditions Known to Further Creative Learning within a Reformulative Frame

A. Process Feedback (as opposed to Product Feedback): The doer's strategy system is regulated by the feedback of his process sequences showing the emergence of his prior work or works. Leapfrogging, short-cutting, emphasis, intensificaition, redirection, "Process intuition," etc., seem to result. First findings suggest that process feedback is better placed on a delayed as opposed to an immediate time sequence in relation to the working period.

B. Self-Discovered (as opposed to External) Evaluative Criteria: For evaluative criteria or goal characteristics, the doer is thrown upon his "internal locus of evaluation." Criteria which are idiosyncratically expressed and congruent with the doer's perception and actions result.

C. Interactive (as opposed to Independent) Setting for Evaluative Activity: The presence of an accepting moderator effects art gains only slightly, but has the strongest impact on changes in self-concept measures related to creative production in art, thus potentially affecting works yet to come.

D. Entry or New and Sustaining or Task-Centered Questions during Interactive Setting: Entry and Sustaining Questions from teachers interact significantly with the student's strategy (Divergent or Spontaneous, as later defined) as determinants of creative learning in art.

E. Teacher Strategy as Related to Student Strategy in Art Learning: present evidence suggests a positive impact when teacher and student are of differing strategies.

F. Time Utilization Habits and Values (Jones, 1964 and Table VIII). The way a student utilizes his time and intends to utilize his time outside the school setting is an extra-experimental variable correlating with learning in art as observed in our experiments. When added to self-concept and personality measures, we see what appears to be a predisposition for learning in art.

G. Analysis of Student and Teacher Interaction during Evaluative Dialogues i Art.

Jones (1964), working currently as a postdoctoral research associate, provides this summary of his analyses of taped evaluative dialogues of students and teachers:

Statements of teachers and statements of students during evaluative dialogues have been judged on a three point scale for each of the following criteria: New (or entry), Repetition (within a statement), Rejecting (a yes-no distinction), Judging (intensity or emotion), Task-Centeredness (not getting off the subject), and Openness (questions calling for, or answers giving, multiple considerations). The length of each statement was also measured in terms of the number of feet of tape it occupied.

A factor analysis of teacher statements showed the existence of three factors, and a factor analysis of student statements also revealed three factors. These factors are shown below as well as the typical student response to each of the statements.

Factor for Teachers		Factor for Students
Long	⟵ followed by ⟶	Task
Rejecting	⟵ followed by ⟶	Judging
New	⟵ followed by ⟶	Long

Correlation has shown definite relationships between what is said and what is learned (or not learned) by the student. Analysis of variance for different groupings of students and teachers according to personality measures has shown differences in learning that may be accounted for by differences of verbal behavior.

The one type of teacher statement which is most consistently of value for the student is the New (or entry) statement. The use of statements of this type correlate positively with gains in complexity of strategy for all students. Long student statements correlate with gains in aesthetic quality for all students. The frequency of occurrence of these two types of statements is not significantly related to the strategy of the teacher and the student.

H. Questions Types, Patterns, and Sequences used by Art Teachers in the Classroom (Clements, 1964).:

To extend the viewpoint from questions and statements occurring during evaluative dialogues in art learning experiments to what actually occurs in art classes, the following brief summary is given from Clements' summary to the U. S. Office of Education:

(1)

Question Type		Frequency 1st	7th	College
Experience	What is your dog like?	41	6	4
Intent	What will you do?	13	4	4
Beginning	Tell me about your pictures?	11	1	5
Identification	What's this?	6	4	5
Process Recall	How did you do this?	3	2	5
Judgment	Do you like this part?	4	18	12
DIRECTIVE QUESTIONS				
Suggestion-Order	Why don't you do X?	3	2	2
Rule	What is our rule for doing this?	0	2	0
OK	O.K.?	2	2	6

(2) In terms of length of answers (Jones, 1964) to be related to gains in aesthetic quality, beginning questions, "Will you tell me about it?" received the longest answers (8 seconds). Judgment questions, "Are you pleased with it?" received the second longest answers (4 seconds). Directive question types usually received no answers at all.

(3) Teachers rarely paused for student answers to their questions. In the average 50-minute art class in which 59 questions were asked, a total of only 5 seconds of pausing was given.

(4) As Clements puts it: "In brief, the shortness of the pupils' answers and the virtual absence of time left for them to answer casts considerable doubt on the value which art teachers attach to their pupils' opinions."

(5) Most teacher questionning (61%) occurred in the Working Period and was therefore, as in our experiments, between a teacher and one student. In the Motivation and Evaluation stages of the art period were 20% and 19% of the teacher's questions, respectively.

III. The Nature of Two Dynamic and Creative Strategies[1]

A. General Statement:

The critical point of detection determinant of the strategy is the beginning of a work of art. Spontaneous students begin with a big organic statement devoid of detail but suggestive of a whole picture. Through progressive medium interaction, centralization, movement, and suggestion, spontaneous students focus upon the whole problem, which they solve through procedural experimentation.

---

[1] Examples of Spontaneous Strategy Criteria: Heavy action forms in space (disconnected); Movement across forms and contours; Medium overlays (medium interaction); Incorporation of accidental forms (process-inspired changes); Suggestive big organic statement from the start (in scale and devoid of detail); Reliance on suggestion for completeness, not an elaboration; Erratic wandering fine lines; Action gestures. Examples of Divergent Strategy Criteria: Off center composition (off balance); Theme and variation within picture (same element varied); Decorative patterns (in detail); Unexpected organizational progression; Early inclusion of detail; Fine line control; Black-white contrasts (solid); Formal distortion (static, drawn out, elongated, abstract). For further details and frequencies of occurrence, see Tables IV and V.

Unlike Spontaneous students, Divergent students begin by drawing with considered fine line control a single element which in some portion shows the early inclusion of detail. As each new element is added, they reveal a constant alteration of viewpoint and controlled shifting of focus within a designated framework in their persistent search for conceptual variety through their systematic openness to emerging possibilities for innovation as they work. Their divergency constitutes a synthetic, elementalistic strategy, dependent upon conceptual flexibility, organizational clarity, and freedom for discovery.

B. Spontaneous and Divergent Personality Styles

Multiple correlations of our tests with strategy identification, factor analyses of these same tests, analysis of the art strategy criteria, and interview data point to opposed behavior patterns for Spontaneous and Divergent students. Below is a generalized summary of these differences. (Beittel and Burkhart, 1963)

	SPONTANEOUS	DIVERGENT
1. Social Orientation	Exuberance Independence Self-Confidence	Self-Restraint Tradition Self-Consciousness
2. Work Orientation	Procedural Flexibility Freedom in Process Holistic Viewpoint Controlled Problem Focus Kinaesthetic Orientation	Conceptual Flexibility Control in Process Synthetic Viewpoint Unexpected Alteration of Viewpoint Field Orientation
3. Background	Turbulent Environment	Supportive Environment

C. General Statement on Fluidity and Stability of Strategy Types

In our major experiment to date, with 96 students, 48 college freshmen and 48 college juniors, all Art Education majors, there was a 69% agreement between the comparative judgment of strategy, as determined by 6 expert judges, for the first studio period, which was uninfluenced by treatment, and the careful and detailed internal or intraindividual judgment done by Burkhart and me, utilizing the 40 criteria appearing in Tables IV and V. This latter judgment I have called the strategy complexity judgment, since it designates the increased number of criteria or increased intensity of existing criteria seen after an individual's first works, considered as a benchmark. Perhaps in art there is no substitute for the long hard look at one individual's productions at a time. Burkhart and I spent on the average an hour looking at each of 96 student's works as we made our judgments.. We allowed the full halo of each individual to encircle us and wallowed in that fearful bog of empirical judgment, "metaphysical emergentism". Believe me, it felt good and appropriate to qualitative phenomena. But it's not the only kind of look we've taken at our data. I merely wish to emphasize that there is no substitute for the "feel" of the data we obtained thus.

To return to my point, 30 of the 96 students did not begin in the strategies in which our internal judgment of how they changed, in terms of strategy complexity, placed them. Thus nearly a third of the students seem to be affected by treatment and/or practice in the strategies in which they work.

Still more mystifying, in terms of external or comparative judgments, students gain significantly in the strategy opposite from their beginning externally judged base, but they gain within their strategy by the internal or intra-individual judgment under classification by the same beginning externally judged base.

Thus it appears that there is more fluidity to strategy than Burkhart and I earlier believed (Beittel and Burkhart, 1962-4). Even so, with our Freshman group (N=48), 73% applied the criteria for strategy complexity to their own works at the close of the experiment in agreement with Burkhart and me. And in using a battery of 6 tests with this same group, post test predictions of strategy agreed 83% with our internal judgments. The story seems to be that the internal and external judgments yield differing but equally valuable perspectives on learning, and that treatment does not clearly determine in any orderly way the strategy in which one will work, although there is considerable mobility, but does affect significantly the amount of complexity and the quality seen within both strategies. That the same treatments affect similarly two creative but nearly opposed strategies as judged from two somewhat antithetical p[illegible] of view gives me some confidence that the learning conditions discussed herein are sound and important.

At this point, I leave the theoretical structure I began earlier, long since extenuated by the length of the latter sections, and describe in brief the experimental conditions, since they have relevance to the conference theme.

Experimental Setting[2]

The relatively invariant envrionment earlier discussed was represented in several ways: First, the subject-matter or stimulus-field was, throughout the experiments, a single, complexly constructed still-life. This still-life was a compact, many-sided assemblage, composed of half a wooden chair, half a brass bed post, flower pots, bottles, slender branches, thistles, an electric socket, lampshade, egg-beater, etc., stabilized by a center post, a drawer, and a cabinet door. These objects were arranged in deliberate associative disarray to stimulate new visual ideas in the student's mind. The still-life invited focus on the whole, on subsections, or on specific details. It could be loved, hated, or ignored, and was.

A further relatively invariant condition was the art medium and materials. The student worked throughout on a 12" x 18" sketch pad of white, smooth, absorbent paper. The medium was India ink, a number 5 Japanese brush and a C-5 speedball lettering pen. Water and mixing containers were available for washes, if desired. Each student worked on a large flat surface where he had approximately 2 square yards of table space and was physically and psychologically isolated from fellow students. Groups averaged about six each to a large art studio, in which the still-life was set in the middle, with the tables encircling it and the students told that they could place themselves or move from time to time at will.

There were four studio periods of 75 minutes in length. Students were told to "warm up" at the beginning of each studio session and, after an interval, to begin their work. Normally, students took about 20 minutes per work and thus averaged three works per studio. On the first picture, students were told that its evolution would be recorded photographically at the end of three, six, and nine minutes and upon its completion. For these "process shots" a light-weighted welded frame to which a camera was affixed was placed directly over the student's on-going work which was photographed with a minimum of interruption (3 to 5 seconds). The completed works were photographed at the end of the period. Each photograph was coded when taken by means of labels designating the student's number for the experiment, the number of the studio period, and whether it was a "process," a "process-product," or a "product" shot, along with the sequential order in which it appeared.

---

[2] Portions of the writing in this and the immediately following section were done jointly by R. C. Burkhart and me.

The studio sessions were quiet and serious. Students understood that they were in an independent learning environment in which they should work in their own ways toward their own goals. Since no grade was given and since there was no teacher present, they felt free to experiment and explore in ways they might not have under instruction. By removing external objectives, supervision, and evaluation from the studio session, a value neutral atmosphere was established in which the student progressively realized that the responsibility for learning was in his own hands. By this method, in opposition to the purely external treatment concept, the student was indirectly encouraged to be more wholly himself in the privacy of the art dialogue and his values were accepted as within the structure of the experiment.

The studio sessions just described were the same for all students and represented the relatively invariant environment which is thought to aid learning. Process feedback and the evaluation of products in relation to goals were clearly separated from the studio sessions to formally represent the self-reflective phase of learning in art. Thus the studio session of the experiment symbolizes the activity phase, and the evaluative session symbolizes the self-reflective phase of the art activity. The separation of the self-reflective from the studio phase has both an experimental and theoretical rationale. In terms of experimentation, this separation permits the systematic variation of feedback and evaluation conditions. In terms of the earlier theoretical discussion, the self-reflective phase is seen as the only one in which learning in art can be influenced without violating the privacy of the art dialogue. It is also the phase which, though educationally accessible, is virtually ignored in today's art instruction.

Problem

The purpose of the experiments was to determine the effect of form, content, and source of self-reflective feedback, as related to on-going art activity, on students' learning strategies in art. These experiments were an extention of earlier studies (Mattil, Burkhart, and Beittel, 1961; **Schwartz, 1964**; Burkhart, 1962), which suggested: (1) the value of "depth" (or continuous work in the same medium) over "breadth" (or shifting of medium); (2) the value of a required procedure for evaluation of his art by the student over no evaluation; and (3) the value of student-performed over teacher-performed evaluative activity.

A four factor design was used, with two levels for each factor. Three of the independent variables were treatments, the remaining was an organismic variable (art strategy classification).

Major results of our analyses of variance are to be found in Tables I and II, dealing respectively with art gains and with changes seen on self-concept and personality measures related to creative performance in art. I have already discussed in an earlier section the value of self-discovered over external criteria for evaluation, of process feedback over product feedback, of delayed over immediate feedback (see Table III), and of interactive (presence of an accepting teacher moderator) over independent setting for evaluation.

C: In classifying students by strategies, did you use "divergent" or "deliberate?"

S: Not "deliberate." Burkhart had talked about "deliberate" earlier, but he meant usually "non-creative," and "not spontaneous."

C: But that's not what I am talking about. I'm talking about a style which I think is also very creative.

S: Would you go over your definition again?

C: Well, your style can be called alternating. Is that your style?

S: It could be called alternating . . .

C: Continuous versus alternating?

S: Tell me what you mean by continuous versus alternating.

C: Well, alternating was diverge-converge, diverge-converge, this kind of thing. Converge-diverge, converge-diverge.

S: These sequences are much more fluent than we originally thought when we observed these strategies. But I do think a person sticks more or less to one because they are antithetical, and you cannot start working synthetically and switch to holistic approaches too easily. In a drawing or painting, you are going to line up the big forms fast, or you are going to work with some control of pieces which you put together. In heuristics of problem solving, these are called the planning and the means-end-control strategies.

C: Which is the latter?

S: Well the latter, pieces put together and constructed under control, we called "divergent." "Deliberate" has the connotation of "preconceived," and these people are anything but preconceived. In some ways they are less preconceived than the spontaneous people.

C: This is why I called it alternating, because you said they start out with a pattern and then they break away from it. This is convergent-divergent, convergent-divergent, convergent-divergent, etc.

S: This may be a good suggestion because I'm looking for a new name which is less confusing. Typically, these people will move off the center of the field, and they begin with some detail and have very good control.

C: Do you mean technique when you say control?

S: Control of their medium. I'll give some particulars. They have what we called fine line control as opposed to the spontaneous students who start with very big, forceful abrupt or sweeping, curved strokes. The divergents will pick up and prefer the pen to the brush. They start off center with small forms which very early get a lot of detail into them. We haven't seen this because we had been looking at ends too much and not processes. As we interviewed the students and saw their process photographs these differences became even clearer, because their thinking was like this as well as their art. These differences were much like Paul Torrance's observations that some children were originators and some were elaborators and that they differed in their backgrounds and personalities.

Both strategies use all of the criteria, to some degree, but they do it at an imbalance level. Spontaneous students have very little elaboration in detail, and it doesn't come in at the end and is suggestive, not specific.

C: You say it doesn't come in at the end?

S: Not particularly.

C: But it comes in any time?

S: Any time. They make a big attack, ignoring details, which is constantly fluid. It's not pinned down at any point, and there is a lot of interaction with the medium-overlay of medium. The divergent, on the other hand, often changes figures and relationships around, but he will work with control and then get an idea and . . .

C: That's why I called it alternating. He gets a certain distance, and then he gets his next idea and breaks away somewhere.

S: Right. And as you point out, his second idea is often at right angles to his first one. It seems as though they take the next least expected idea--maybe because the goal or problem is open more in art. The divergent likes to surprise himself with this transaction, too. I frankly don't think they know where they're going.

C: Do the spontaneous?

S: More so. They feel it--I guess they know it much more. The divergents work with more "coded" stuff, as psychologists use that term. They are full of associative specificity.

C: The divergents produce several pictures in one, and the ideas are sequential? The spontaneous have an essential idea?

S: Yes. In the one case everything conforms to or is constructed from the pieces, in the other the pieces conform to the essential ideas.

C: The divergents produce sequences of ideas?

S: Sequences that build to some idea, and sometimes they get integrated at the very end.

C: Put them all together just like this conference.

C: We find these same styles in people responding to sound effects. Some will make sequences of sound effects, where others will get the big sense of a unifying coherent one.

S: Precisely. I think I see these same strategies in students I advise in research.

C: Let me ask another kind of question. When you are playing with these outside variables are you getting people to switch processes or techniques?

S: Do you mean do these have an effect on how we thought they worked to begin with?

C: Are the outside variables switching strategies? Can you get different effects of art this way? I guess I mean is one of these a better artist than the other?

S: Well, I'd say that if I gave spontaneous art to a group of judges now, it would be preferred over divergent, because of cultural emphasis, although "pop art" and "hard edge painting" are in the ascendancy now as a counter force. These are cyclic phenomena, and I think this is one of the reasons it behooves us to publish our picturesas well as our figures.

As for switching strategies, as pointed out in my paper, as high as almost a third seem to do so, over a four week period. We judge strategy complexity by forty criteria. These we made descriptive so a judge can use them dispassionately and not get into arguments. You can agree whether a picture has rougher edges as opposed to smoother edges. You can agree whether a picture starts on center or off.

C: Do you apply them to the four progress pictures or just to the product?

S: We looked at either the number of criteria that popped up that we couldn't see in the base of the student's first week's, uninfluenced works, or the increased intensity of these criteria over his base. For want of a better term we refer to this as his strategy complexity index or score.

C: Are there any value judgments--that is, good or bad--in these criteria?

S: There are not meant to be. If there are they creep in through us as judges.

C: How are they criteria, then? Do you mean they're just telling that it's quantitative? Whether they exist or not?

S: At this point it's whether they exist or not. Let me go back one step. We did earlier study, in products, criteria which were discrete and descriptive but thought to correlate with end values honored in the field of art. We factored these criteria and found three domains: the formal, the divergent, and the spontaneous.

C: Oh, your purpose is just descriptive, is it?

S: Let me go further. In our studies we had up to now dealt mainly with aesthetic quality judgments, and this reflects a cultural bias which is shifting. Morris Weitz at Ohio State claims that art is defined by the fact that you can't define it. It's a thing that defines itself perpetually anew each time it comes out. It means to do so. This is the law in which artists believe.

C: We might want that statement for scientists. Say it again.

S: Well, I was using Weitz's definition which says that art is that class of objects constantly needing redefinition, or that you can't define it, at base.

C: This is true for artists and for scientists on the fringe. It's almost exactly opposite from the science that gets taught.

S: I think there is an agreement between the two, especially on the frontier, where things are emerging.

C: And that's where the true science is. The other is just double checking it.

S: We aren't semantically organized that well in art.

C: That distinction about the scientist being better semantically organized is interesting.

S: Well, the scientist might trap himself then, more easily.

C: Did some of the treatment variables have an influence on what you call an emerging style?

S: As far as I can tell, the treatment variables did not influence the change in any orderly pattern. So I attribute the change to practice and feedback, in general, and to internal system changes more than treatment changes.

C: The kind of question I'd like to ask now is to kind of move away from the experiment and tell us what you know now, what this might mean in terms of audio visual?

S: Well, I want to confess that what I deal with could be taken with the same grain of salt that Ray Hyman talks about when he goes from the laboratory to the "natural setting"--even though there is no such thing. We tried, however, to build the studio experience symbolically into our experiment. It's a representative model of how we think one acts like an artist.

C: Well, you have external variables of the teacher, the treatments, etc.

S: That's true. In terms of the treatments, the strongest is process feedback--the recycling of a person's own output in process form. The second strong effect was that of reinforcing what Rogers has called the internal locus of evaluation. Apparently we can't see enough in the developing art of a person from the outside. What we bring to bear, in my honest opinion, messes up the works. The student who uses the criterion "to quit scratching over" is using a perfectly good criterion even if it fits only her. When you see her works and the criterion, you learn what the problem is. Usually, as teachers, we like to deal with something more profound or abstract, but this is what counted to her at one point in time.

Relevance of the Foregoing to the Conference Theme

In the utilization of existing but little used instructional media and in the projection toward new instructional media, it is my belief that the rough hewn theory and the findings from experimentation discussed above provide anchor points for recommendations. The position I will take is largely that more theory and less gadgetry is the urgent need; that existing media will do much of what I will recommend; but that exciting new possibilities in newer media can help enlarge and extend our front. My basic view is almost psychological and therapeutic, although I will engender the ire of many of my profession when I so state it. The primary focus is the individual student, then the environment which unleashes his reformulative power, then the teacher or "change agent" who can project genuine interest, accept and clarify, and in general cultivate excitement and newness congruent with the student's perception or as modifiable by the student's perception and goals. The ingredients are important precisely in this order. There is nothing essentially innovating in this, nor does it require much in the way of instructional media; but it is my genuine conviction from observation and evidence that it is relatively rare that the conditions I describe exist in practice in public schools, colleges and universities, or art schools.

At this point I must diverge to suggest the openness I sense in the very structure I have described. Last Spring term, I found myself involved in seven detailed case studies of college students without art background who were in an art learning environment much like the one I presented. I had not intended to do case studies, but found I had to. These students were part of a large general education team teaching class covering art, music, and theater. The course is called "The Arts: The Creative Process." They had just completed "creative projects" done on their own, outside of class. For these they had kept a journal, covering 6 or 7 weeks. In class they had been exposed to discussions, demonstrations, participation, and they had read some of the classic essays on the creative process.

I was struck with the "lawfulness" of the internal and private landscape out of whicheach project and journal arouse. I had known that this was so, but the content here was so rich and, perhaps because the group of seven could be isolated in my mind and I was to have three weeks of further contact with them exclusively in an art studio. I could focus on each of them.

I decided to have three of the people work from the still-life we used in our learning experiments, while the other four I would place in another large room, give them each a table as their "studio," and have them work on a "theme," any theme that was meaningful to them. Further, as with the still-life, they could change or "move around" as they saw fit, from studio period to studio period. There were to be six studio periods, three lasting an hour, three lasting two hours. I referred to the thematic group as working from "inside the head junk" as opposed to the still-life "outside the head junk."

Otherwise, I maintained the delayed photographic process feedback and self-discovered evaluative criteria variables found to be most potent in our learning studies. Why I detail all this is that I was amazed again at the linkage between what was produced by these 7 people and their journals, projects, and life histories. Psychologically, this should not have amazed me. Educationally, it did, in that I renewed my belief in the self-direction and internal consistency of the individual producing art.

The inside-the-head-junk group, particularly, utilized in new ways ideas, recurring themes, and techniques appearing in project and journal. Very often they worked their way from and out of ideas and images unresolved from upper elementary or junior high school days. They shamed art majors in the depth of the content or the ideational burden which their art was meant to carry. And all of this had to work through the narrow but enlarging funnel which was their mastery over their medium. I saw clearly, too, how little I would have sensed had I not had the preparation to focus upon their work. I brought their independent projects to my office and studied them closely, journal in hand. At the close of the last studio period I conducted an hour long interview with each. I then spent a week transcribing these tapes longhand to further sense what was there.

I say all of this to loosen the structure. I did not "teach" these people in the transitive sense. The invariant environment did not need the still-life. Those working without it were more deeply involved, kept new journals voluntarily, sketched ideas outside the studio, and in general harnassed their past and present to creative production. The evaluation form also went by the wayside, when I found that three blank sheets stapled together elicited much more involved evaluation than the set form for self-discovered criteria. (Of course, coming after the form, it might have been like the blank T.A.T. card.)

Thus, my point is reiterated: the individual himself is the summum bonum for creativity in the arts, regardless of his stereotypes, lack of training, etc. His life history, perceptions, and goals transcend the environment, classifications, and treatments we thrust upon him. And while we cannot be sufficiently sensitive to him, we can entertain his products and actions, whatever their nature, as attempts at self-direction and self-actualization.

Upon this base, not without precedent in the journals of artists and the writings of art educators, are then placed the conditions of self-reflection through feedback or recycling of one's own processes, of evaluation through one's own criteria (or from an "internal locus"), and of an accepting, interested "other" who can react "congruently," bring in newness freely but not prescriptively, and who can listen and share excitement.

As for instructional media, it interests me that delayed photographic process feedback appears to be superior to immediate, at this point in our knowledge. Thus a key question to answer in the use of instructional media is that of how iconic feed back should be. I feel that it should not be so iconic that the process is relived, but rather be abstracted to the point where the student leaps directly into his own conceptualizations of where he is and where he wants to go. In short, the process feedback should probably be "denatured" considerably.

The environment, as second ingredient for creative, reformulative learning in art, needs the type of security or stability that comes from consistency and relative regularity or invariance of conditions. Barkan(1962) has pointed out that sheer novelty in the use of media had its purpose when we were revolting against the academy, but that this point having been won we need not compulsively search for experiences like wet noodle drawing, especially if we mean to help students to "think like artists."

Against a background where pursuit of depth under idiosyncratic definition is encouraged, the individual focuses on his own dynamics, his own change--and, I might add his own means and techniques. Part of artistic lore is the belief the artist has in his own secret means or processes and the feeling that they should not be revealed. "Tell everything," someone has said, "but not the song the sirens sing." The world as contained in us in our imaginations, like our very selves, is never sufficiently represented by our actions and symbolic products, even though this inner world is constructed largely by these very actions and symbolic products.

By now you may detect the nature of my bias. I wish to study creative learning at its fundamental level, in terms of the individual as a dynamic and open system. The teacher enters as a clinician improving the environment so that the system can gather together its energies and release its powers of self-direction. At best, to borrow an anthropological term, the teacher is a "participant observer" in this transaction, which means that he becomes involved and hopelessly colored by his involvement. I do not at all see this as negating scientific study of conditions for creative learning, even though I may sound more and more like a "hopeful" existential therapist.

And I wish to point out that I have been dealing exclusively with the problems of image-making, as seen in painting and drawing, that most subjective and yet culturally influenced kind of art. There are many other kinds of learning in the art fields, but I have not touched upon them. Some require, I feel, opposite emphases. To the best of my knowledge, it is preferable to be directive and analytically specific when a student is learning basic throwing on the potter's wheel, since this is largely a perceptual-motor skill in its early stages.

I have used new media to good ends and find them exciting. The motion-picture-like projection device available in some closed circuit T.V. systems, for example, is full of wonderful possibilities for the visual arts. Details can be shown enlarged many times, as, for example, when the potter's hands on the clay appear 15 feet high. One time we used the motion potential and overlay potential of the T.V. camera to force the perception of naive students looking at a still-life as the stimulus for their drawings. There was an audible gasp as movement was introduced and as the point of view changed from side to top, and then to side and top simultaneously, or when a mysterious "artist's hand" brought a quick white line right over the image on the screen. Such devices improved the work of especially the poorer students (Beittel, 1962; Burkhart, 1962) but it is humbling to relate that the most gifted students did better work outside class altogether. In short, such devices can be harnessed in terms of their rich potential for instruction, but they get at results which are, to my way of thinking, more spectacular than fundamental.

The lack of imposed structure, which Taylor described in one of the papers sent out prior to this conference (Taylor, 1962), is most appropriate to instruction in the arts in the kinds of creative learning I am describing. Our search for appropriate structure has succeeded in only a few areas, and these usually related to more precise knowledge of the individual. As indicated, the teacher can profitably bring in "new" questions (Jones, 1964), pause for responses (Clements, 1964), and strive for long responses from students (Clements' "beginning" and "judgment" questions, and Jones' findings that "long" responses from students correlate with learning).

In addition, a recent experiment supervised by Burkhart and reported in Table III, indicated that there are complementary forces at work furthering creative learning, in which the kinds of questions (entry or sustaining) interact with the strategies of students (entry with spontaneous students, sustaining with divergent students, in keeping with their respective needs to enlarge the problem base and to focus on a goal); and in which it appeared that teachers interacting with students of opposed strategies is a good arrangement. Other than these variables, we maintained our "best conditions" as learned from previous experiments. Both of these results suggest some importance for "openness to the opposite" which can be structred into the learning environment where known good conditions have already been established.

The type of experiment indicated above is an important utilization of the research experiment as an instructional medium in itself, as it is included in the training of teachers. To my way of thinking, several such studies which were carried out under Burkhart demonstrate the profitable marriage between innovation in education and research experimentation. When combined, student and teacher alike are led to reformulation and there is an assurance that constructs will be truly operational and that means for evaluating them will be built in.

As further example of the connection between research and innovation, I invite your attention to Tables VI and VII, where Jones takes criteria from the base in our studies of two-dimensional art and projects these into characteristics of students and materials for three-dimensional work and builds these into a plan for a new experiment. I have no doubt that this will work toward both better instruction and new knowledge about learning in art.

In a recent paper, Hyman[3] brings up points closely in sympathy with mine in relation to our experiments in art. Both theoretical positions emerge gradually from experimentation. Like him, I am hesitant to generalize beyond the laboratory (or studio). As Hyman puts it: "What we recognize as creative output in natural settings depends on many considerations beyond just psychological factors."

He makes the further point, on which I am vulnerable, that we should be hesitant "to predict from isolated effects to combinations of effects." Is it possibly more like the artist's task, for example, to evaluate his work from an internal and an external point of view simultaneously, and such a combination may be more valuable than our clear findings, but we have not asked that question.

---

[3] Ray Hyman, "Knowledge and Creativity." Talk to Second Annual Creativity Workshop, University of Utah Summer School, June 17, 1964.

Along this same line is the dimly perceived necessity to conceive of what I can only call "dynamic treatment variables," or those which change their shape in time (as static ones may be said to change their meaning in time). A simple example is seen in Table VII, where Jones has "breadth" (or many media) followed by "depth" (or focus on one medium), and vice versa. Sequential and pattern effects may be the crucial step to broader and more inclusive generalizations about creative learning in art, just as I feel, but cannot yet adequately verbalize, that our use of "strategies" organizes in much more elegant fashion than anything heretofore a vast "coterie" of conceptual and procedural dynamics at the observable core of image making in art. In short, instead of Humpty-Dumptism, we have, at the least, Tweedledum-and-Tweedledeeism. And I cannot rest here, either, because two strategies is somehow flat, and I know the world is N-dimensional.

That we need broader attacks I have no doubt. In a culture where more and bigger is often confused with better and deeper, I must still acknowledge that any release of energies effected through funds and gadgetry and even Hawthorne effects are none the less important. The government itself, through the newly approved National Council on the Arts will turn attention toward the arts and needs all the imaginative and scientific guidance possible.

The fact that the arts have been included in this work conference is most significant to me. I dare to think of a new renaissance in which art and science as the two noblest constructions of the spirt of man will again find their place in each man and generate a productive dialectical tension, suggestive of that "science of mankind" with which I began this paper, and slowly accumulate into that profound modern myth, "creative man."

C: I would like to be a bit more directive. Do you think that from your study you could set up a model or some type of generalized paradigm for designing new media devices?

S: Well, the model that James Finn had for creating instructional media is actually the same model that curriculum development people use. You make your best step forward, with knowledge, and also design an evaluative system, or "educational intelligence," so that feedback will help in further revision, improvement, and accommodation.

In terms of the individual, I think it needs to be in terms of his own art. He needs to be reinforced in his own evaluative system, with his own stuff as inputs, and he needs some chance to reflect on his actions. Process feedback gives him this chance. As teachers, we haven't learned to use ourselves in this setting enough yet.

C: Well, I'd still like to hear you continue the broad things you found.

S: Given this generally better base, we can raise the question as to whether we should give people more such conditions. Well, my opinion is, yes. I think it's good for a person to go through the kind of experience represented by our experiments, and I would like him to conceptualize on it. When we called students in for interviews, we put all their work out and said, "Tell us about your learning here." And the students tried to theorize about what took place. This gave us and themselves insights. It brought to their mind a form or model of learning, an experience which they don't get in school. It's amazing. They don't get to feel the form of how they learn in school at any point, as far as I can tell. This is a sad thing. I really think instructional media could help on this point.

C: It's interesting that when teachers use this little film, "Squeak, the Squirrel," they rarely talk about his learning process. They get all involved about what squirrels eat, and that sort of thing.

C: You said that feedback is valuable and that it is almost information seeking. Let's have a system to give this information and to find out what it means. The teacher tells him what it means. This is not as good as if the person tells himself. It's information seeking, and the system helps him get the information, but if the system tells him now what he must do, as in close supervision, that's bad.

S: Right. The system provides this feedback. In the normal studio it's not provided. Information is not stored up so the person can see himself moving; he is not given feedback. Yet for process photos, not a lot of expense is involved, say, compared to a language lab. This kind of approach is without our grasp.

C: Let me go one step further here. In effect you have some evidence that if the teacher comes in to tell not only what is happening, but what they should do about it, this tends to be a negative contribution of teachers.

C: Can I push hard on two things? Did you say you had personality data on these students? Is there a relationship between personality type and strategy type?

S: Yes. Very roughly it's like this. . .

C: Is it pretty good?

S: Pretty good. The spontaneous type looks like our "creative personality "--which makes me a little critical of the creativity literature. Our divergent is self-restrained, more traditional, more self-conscious. He does show conceptual flexibility. He deals with control in process, not freedom in process, but freedom in thought, in my opinion. He deals with a synthetic viewpoint, he unexpectedly alters his viewpoint, and he is more field oriented.

C: Isn't MacKinnon saying that there is much need for self-disciplining activity and a certain rigidity, perhaps?

S: This is why I think the two strategies help each other. If you asked me for an image of what would make a profitable approach to dyadic creativity, to use Murray's term, I would say put two of these strategies together and you'd get it, as a team. Both strategies are non creative at bottom, creative at the top. It means there are at least two ladders up.

C: Can't we forget we're talking about art and talk about self-learning strategies now?

S: It's a kind of reformulative learning dealing with self-correction under sufficient feedback, with self-evaluation, if I can summarize in that way.

C: Which is clearly related to personality?

S: Right. I think it is. But the same "good" conditions seem to help both.

Table 1

Summary of Analyses of Variance: Effect of Self-Reflective Learning Conditions on Art Gains
N=96

Source of Variation and Direction of Differences	Dependent Variables																	
	Comparative or External Judgments								Intra-Individual or Internal Judgments									
	Aesthetic Quality		Spontaneous Strategy		Divergent Strategy		Within or Greater Strategy Gains		Within or Greater Strategy Gains		Spontaneous Strategy		Divergent Strategy		Combined Strategies		Opposite Strategy	
	F	P	F	P	F	P	F	P	F	P	F	P	F	P	F	P	F	P
A Self-Discovered>External Crit.																		
B Process>Product Feedback	5.18	.05							4.9[illegible]	.05					5.76	.025		
C Interactive vs. I[illegible]. Sit.																		
D Spontaneous>Divergent Students					7.48	.01			3.67	.10	21.48	.005			3.01	.10		
D Divergent>Spontaneous Students			10.55	.005									4.93	.05				
AB																		
AC																		
AD																		
BC																		
BD																		
CD																		
ABC																		
ABD			7.64	.01	4.97	.05							3.20	.10				
ACD					3.37	.10												
BCD																		
ABCD			4.59	.05							3.87	.005	5.90	.025				

Table II

Summary of Analyses of Variance: Effect of Self-Reflective Learning Conditions on Gains on Eight Personality Measures
N=96

Dependent Variables

S rce of Variation and Direc- t n of Significant Main Effects	Complexity		Aestheticism		Theory		Social Self Determination		Originality		Creative Independence		Flexibility		Object Question	
	F	P	F	P	F	P	F	P	F	P	F	P	F	P	F	P
A elf-Discovered External Crit.									3.36	.10	3.19	.10				
B rocess Product Feedback							2.79	.10								
B roduct Process Feedback													4.36	.05		
C nteractive Independent Set.			6.74	.025			4.22	.05								
D pontaneous Divergent Stud.									[illegible]	[illegible]	4.76	.05				
AB																
AC					7.49	.01	3.09	.10							7.11	.01
AD									6.98	.01						
BC									3.27	.10						
BD																
CD																
ABC																
ABD			3.78	.10					7.07	.01						
ACD	6.41	.025					3.12	.10	8.23	.01	5.16	.05			3.79	.10
BCD																
ABCD																

Table III

Summary of Analyses of Variance: Effect (1) of Delayed vs. Immediate Process Feedback, (2) of Spontaneous Teachers vs. Divergent Teachers vs. No Teacher, (3) on Spontaneous vs. Divergent Students, under (4) Sustaining vs. Entry Evaluation Questions, on Art Gains

N=31

		Dependent Variables							
	Source of Variation and Direction of Significant Main Effects	Aesthetic Quality		Spontaneous Strategy		Divergent Strategy		Within (or Greatest) Strategy Gains)	
		F	P	F	P	F	P	F	P
A	Delayed Immediate Process Feedback							7.60	.05
B	Teacher (by Strategy) vs. Independent								
C	Student Strategy								
D	Sustaining Entry Questions					5.02	.05		
	AB								
	AC								
	AD								
	BC								
	BD								
	CD								
	ABC								
	ABD								
	ACD								
	BCD							14.65	.005
	ABCD								

Table IV

Self-Reflection
Comparative Strategy Complexity Judgment:
Scaled Spontaneous Criteria Arranged in Descending Order of Rarity

	Criterion	% (N=96)
1.	Heavy Action Forms in Space (Disconnected)	14
2.	A Spatial Network through Voids Surrounded by Dynamic Dark Forms	14
3.	Movement Across Forms and Contour	17
4.	Web-like Solidification across Objects	21
5.	Direct Forceful, Flowing Movements (circular or long)	22
6.	Enrichment through Diversity in Strokes within Picture	28
7.	Incorporation of Accidental Forms (process-inspired changes)	30
8.	Medium Overlays (Interaction)	31
9.	Open and Broken Contours (not at joints)	31
10.	Suggestive Big Organic Statement from Start (in Scale) Devoid of Detail	33
11.	Rough and Varied Edges	36
1	Patterns of Broken Light within Darks	37
13.	Direct Abrupt Quick Motions	38
14.	Action Gestures (resulting from the distortion of the contours of the subject matter)	42
15.	Erratic Wandering Fine Lines	48
16.	Central Emphasis (through the Balancing out of the dynamic elements in juxtaposition to each other)	49
17.	Movement within Shapes	54
18.	Reliance on Suggestion for Completeness, Not Elab.	55
19.	Progressive Development of Work as an Organic Unit	64

Table V

Self-Reflection
Comparative Strategy Complexity Judgment:
Scaled Divergent Criteria Arranged in Descending Order of Rarity

	Criterion	% (N=96)
1.	Only Single Element (for subject matter)	20
2.	Transparencies and Overlapping Spatial Planes	23
3.	Theme of Variation within Picture (same element varied)	23
4.	Off Center Composition/Off Balance	24
5.	Unexpected Organizational Progression	30
6.	Decorative Patterns (Detail)	30
7.	Black-White Negative Reversals	31
8.	Edge Contrast Edge to Edge (tensional)	34
9.	Fine Line Control	37
10.	Begins with Single Element	37
11.	Static Spatial Suspension Floating (no base line implied)	37
12.	Constructed Spatial Network Connected (welded together)	38
13.	Single Element Focus	41
14.	Early Inclusion of Detail	42
15.	Formal Distortion (Static, drawn out, elongated abstract)	43
16.	Progression of Theme Picture to Picture, Period to Period	44
17.	Variation of the Same Element Picture to Picture (form not just treatment)	45
18.	Change in Size Internal Scale Alteration	45
19.	Black-White Contrasts (Solid)	51
20.	Elimination of Non-essentials (less cluttered)	55
21.	Flatness (picture as a whole in pattern)	67

Table VI

Comparison of Spontaneous and Divergent Criteria Developed By Beittel and Burkhart to Show the Emphasis Placed on Structure And Surface by Divergent and Spontaneous Students

Layman H. Jones, Jr.

Spontaneous criteria suggesting a concern for structure	Divergent criteria suggesting a concern for surface
Suggestive Big Organic Statement from the Start	Decorative Patterns
Progression development of the work as an organic unit.	Edge Contrast Edge to Edge Tension
Central Emphasis (through the balancing out of dynamic elements in juxtaposition to each other)	Fine Line Control
	Early inclusion of details

Spontaneous criteria suggesting lack of concern for surface	Divergent criteria suggesting lack of concern for structure
Rough and Varied Edges	Only Single Element
Erratic Wandering Lines	Off Center Composition Off Balance
Incorporation of Accidental Forms	Unexpected Organizational Progression
Medium Overlays	Flatness (picture as a whole in patterns)
Reliance on Suggestion for Completeness	

Table VII

Proposed Research Design for Experiment on The Effect of 3-D Mediums Upon Learning in Art During Training in Breadth and Depth

Layman H. Jones, Jr.

(Population: Freshman art majors with little previous
experience in 3-D work)

MATERIALS (Wood, Clay, etc.)

		Breadth followed by Depth		Breadth followed by Depth	
		Spontaneous	Divergent	Spontaneous	Divergent
PROCESSES (Carving, Modeling, etc.)	Alternating Problems Emphasizing Structure and Surface				
	Only Problems Emphasizing Surface (Carving, etc.)				
	Only Problems Emphasizing Structure (Modeling, etc.)				

Note: The cells will be composed of an equal number of Spontaneous and Divergent Students.

Table VIII

Significant Correlations Indicating Patterns of Creative Time Usage for Art Students

Layman H. Jones, Jr.

ALL STUDENTS

Value Related to Time Use	Use of Time	Number of Significant Correlations .05	 .01
Creative Personality (first for Spontaneous Students)	History of Independent Time	20	9
	Desire for Independent Time	8	2
Art Gains, Creative Personality (first for Divergent Students)	Values=Desired Time (integration)	8	1
	Values= Time (integration)	8	1
	Desire for change in Time Usage	7	

SPONTANEOUS STUDENTS

Value Related to Time Use	Use of Time	.05	.01
Learning Predisposition	Uninterrupted working periods	7	2
Gains in appreciation of opposite strategy	Other independent art activities	1	
Gains in opposite strategy	Independent Art Production	2	

DIVERGENT STUDENTS

Value Related to Time Use	Use of Time	.05	.01
Learning Predisposition	Regular working habits		1
Gains in appreciation of opposite strategy	Art class time	1	
Gains in opposite strategy	Voluntary schooling		1

Chapter 12

Stocktaking Between the Areas of Creativity and Instructional Media

Open Discussion of Participants led by Calvin W. Taylor
and Edited by Frank E. Williams

S: We have had various, should we say, extra valve systems for getting ideas into the conference. We have also been fortunate in having a representative from our sponsor, the U. S. Office of Education, with us throughout the conference, and so before proceeding with our stocktaking session I should like to have him say a few words to give us a feel of their needs in this area.

C: I have been in a very fortunate role of seeing a group of very competent and highly able individuals interact, and one of the things that has intrigued me I think consciously or unconsciously is that most of the individuals around the table have been interacting in terms of models that they themselves have established; and they relate most of the remarks that others have made to their own set. Now theoretically I have known this, but this was the chance to see it in a very real way. Actually I think we tend to even take the terms that others used and look at these terms in our own experience so when a word is used it means something to us and something else to someone else, and this has been reasonably apparent. I think most of us tend to be more comfortable in some sort of a structured environment but I don't know what this kind of environment is. I was just looking out there on the golf course. That's a beautiful place which many of us found just to walk out and look at the water, but most people have to have a reason for going out there so they play golf. Not that I am opposed to golf, I like it, too, but this is a rationale, and this is a good reason for them to be out there where they are at the present time. Well, we could go on with this kind of thing, and this is not my purpose so let me mention two or three points.

First of all this conference design has been pretty well spelled out in these three, four, or five specific objectives, and it has been clear that several of them have been met and met well. Now this stocktaking session in a sense is the hardest part and in another sense perhaps the easiest part of the conference which comes into focus. There are two things that I think this conference should do. You have laid a strong background; you have had many different perspectives. The editor is going to have a real job on his hands when he tries to bring these together in some semblance of generalization. I would go along with your suggestions that it should be a real joy to follow the conference from a transcript just as it took place, but I have a feeling that most of the people who read conference proceedings are not going to integrate this in the same sense that we would hope. Some place there must be a final chapter in which we begin to draw together the concensus or maybe the main points. I think this should be done for two purposes and these are spelled out in your objectives. One is that we get some model or models that will enable us to see where research needs to be done. In other words, what areas of the unknown are researchable, and what kinds of research seems to be realistic. Now we need this as a guide in the Office of Education because we are confronted with proposals and suggestions from a wide variety of sources, and while it is not our role to say this is good or this is bad, if we have some sort of a model that at least is meaningful to us in this area, I think perhaps research proposals could be more meaningfully interpreted. So one outcome I hope will be established is what kinds of research do you as a group feel could make a profitable contribution to this whole area of creativity as it relates to a school situation.

The second thing is what do we now know that can be put into operation with media that now exists. I am reminded of the observations made yesterday using the films from the chemistry studies group that these might be much better films for creativity if we would stop the film after posing a question. Now you see here's an existing media, an existing film I would say that all we need to do is stop it, cut off the tail of it, throw the answer away or else show it to students next week. That kind of thing. So maybe a very simple thing like this would be a useful kind of suggestion in the day-to-day operation of the classroom behavior of teachers. What can we do with the things that we now have? I was very much interested in observations yesterday that in working with media we need to begin to get some sort of perimeters within which we can decide how the media are to be used. It has been pointed out we may need a type of media that is different for social creativity than for productive or personal creativity. These were the three general types of creativity mentioned. So that our role this afternoon, I think, will be one of trying to relate the theoretical constructs of creativity that we have been playing with around the table here for the last two or three days to the very practical on-going day-to-day classroom operation of the teacher. I have had a chance to see a lot of classrooms across the nation in one way or another, and I think that in the main there is more receptivity to this kind of an approach than there has been in the past. We have not reached a peak in acceptance of this. I think we are still in a highly receptive area, but the one thing that teachers and administrators are asking for is how to do it. Now whether we can give these answers to them or not, I don't know. They all say all right we think creativity is good, we think we should teach more creatively but how can we do it? So I think this means maybe two things. One, it may mean that we are going to have to find some way of using media to help teachers see what their role is. Maybe this is one of the things that we need to play around with a bit this afternoon. In other words, how are we going to retrain some of the teachers who are going in turn to try to develop creative behaviors in individuals, that is, in their students? The second thing is, what are the specific things that we can put into the environment of students so that they can find it as an environment that they themselves can be creative?

S: In terms of summarizing what is known through research in creativity and where are the areas in which more research is needed, some of this has already been partly done in our stocktaking book; Creativity: Progress and Potential. That in a broader sense has been done, and since our time is relatively short I would prefer if you don't mind if we think of research on the joint topic creativity and instructional media with emphasis on implimentation. Now you may broaden this out a little bit more and say all instructional media in the whole classroom. If you want us to get broader, that's fine with us.

C: I think it is instructional media as it relates to the classroom environment. I think it would have to be this.

S: Teachers cannot be left out completely because we have to debate early as to whether to give a lot of instruction to the teacher on use of media for developing creativity or whether to let the teacher just take her own steps. I think we realize that we have got to contend with the teacher.

C: I think the thing that I was trying to say is that you can use instructional media either for preparing the teacher to become more effective or as a tool which the teacher can use to be effective in the classroom

S: Here we are playing a new role. We have kept the conference fairly open in searching all ways, but now we are kind of changing our ball game a little to zero-in on these two points. What kind of further basic research needs to be done and what can we do to modify existing media? Shall we separate our ideas into these two areas?

C: I have two ideas here for example, which came up somewhere in somebody's discussion yesterday. I was thinking of applying them to using films as a technique not as a research area. Suppose the teacher showed a film and said at the conclusion of the film or said in advance of the film: "I am going to ask you to list all of the questions that you can think up that this film has made you think about that are not answered in the film." Then number two as a research area, suppose two different versions of films were studied to determine their effectiveness in this respect. One could study how much questioning behavior does each version of the film enlist? You could actually research this question in some of the existing media. I thought of this idea as just a practical technique but I think then you could begin to turn it into a research question, too, and study the media in this respect.

S: Shall we start by letting me direct this toward what could be fairly readily developed now, and then end up with the more basic research questions. Should we try ideas first on what is here and now and then move on to what could be done. What can be developed out of existing media and then what needs to be done by basic research in developing new media.

C: I would like to attempt this on the blackboard here for a minute. I will try and get to the question of doing something with what we have now. It seems to me that we might approach the problem from the old stimulus response paradigm and talk about the "S" input. The question might be how can we arrange or manage the input stimuli by an instructional media device to bring out whatever we are trying to get at in creativity? Instead we have only been inclined in the past to look at the output response end. What does the teacher do, or what does the class environment for other students do to get the desired response? Let me give a couple specific suggestions such as using instructions. You may merely instruct your class to think of answers that can't be answered as they look at the film, or in asking questions, or trying to think imaginatively how many other ways would this be done. Instead of giving answers in the film you might insert ques or questions. For example, in a science film the teacher might ask, "How else could you use electro-magnetism than the way shown in the film?" Instead of using the media device the way it is designed you have to insert your own questions. Some film producers now are inserting film questions right into the film. Then you might carry a technique for arranging the inputs to develop creativity further in working within a model for creativity such as the Guilford model. For example, you may try to get at associational fluency, this is one divergent thinking process that I like because I think it underlies a lot of creative behavior. Fluency is one reliable measure that we have and we have talked about it at this table quite frequently. Could you draw from the model of intellect then and maybe on the stimulus input end use some type of a media device designed and managed to get at associational fluency? Or could you just give the que as an instruction at the beginning of the film; "Now class come up with a number of associations out of the information that is given in the film."

S: This is cutting across both basic research and the tangible stuff. I still think we have got to start with one of the two of these areas which is what should we be doing now with little effort or what could we be doing with a little more effort in getting existing media in shape? Maybe we could be starting with the input end and switch then to the output end.

C: Let me give one more illustration of what is needed. This last week I was in San Francisco and dropped in on what they call a demonstration listening corner. I heard only one or two creative statements, and they were pretty well done. These were demonstration kinds of things, but in the main the things that these youngsters were listening to were rather directed kinds of activity, very specific kinds of things. Now the teacher should have asked for other ways that the device could have been used; as a creative rather than a conforming device in one way or the other. Are there ways that we can begin using the things that we now have? Should we make this an open-ended kind of thing? The teachers that I observed usually would say: "Turn to page so and so," or "Count the number of people who have on this kind of dress." It was very much this kind of thing. Now surely many media devices could be turned to a creative end if we could only get the clues from the kinds of models and kinds of things that we have developed here the last two or three days.

C: One could be basic instructions by the teacher for students to think original. This could be given by the teacher for any existing device.

C: The teacher could point out people with different colored dresses on page so and so, or different objects, etc., students could find how many ways they could put together whatever information there was there if someone showed them how. Leave the ways you could do it, the ways you classify information and the ways that you look at information to the student. Then maybe after a while after a student checks his ways of doing these things by other people's ways he may find that he has ways that no one thought about. For example, he may find he can count the people, he can count the people from different directions, he can count people barefoot versus those not barefoot and learn all kinds of classifications.

C: I agree with that excellent suggestion. I think categorization behavior is very important and stimulating to this kind of a program.

C: I would like to back up a little bit since you have mentioned it and indicate some of my reactions to what has been going on here the last four days and how stimulated I have been by them and how much I have felt that it is a pity that we don't have all of the school teachers and school administrators in the nation sitting around here listening to this.

C: We could send out invitations. (Laughter)

C: Yes, but I think also you should send out the individual too that participated in this and we know that this is a physical impossibility at our age...

C: I have felt that we have prepared papers here and exchanged ideas for producing a monograph for distribution so that you in effect have done all the research necessary. You are the best actors in the world in this area and you have prepared the scene for a marvelous motion picture on the subject of creativity for use on television or distribution along with the monograph so that this conference can be brought to people. As I have been sitting here and visualizing sequences I think it would be great if we could have this information developed over the faces of the individuals who created it. I suspect that there are not very many first grade teachers and second grade teachers in the nation who have ever seen the face of the men who have researched creativity and all the glory that is in their faces. I would like to suggest that we seriously consider the possibility of accompanying this monograph with a good 30-minute demonstration film embodying in that film the people who have been responsible for these ideas and then inserting demonstrations, actual classroom demonstrations for developing creativity. I was listening to the speaker this morning and I was simply overwhelmed by the potential for showing how he works, the reactions of his students, and the interaction he gets. This is drama of the highest order and you cannot convey this, I insist, in a printed publication. I don't think we should expect a printed publication to carry this weight. I think that there should be referencing back and forth. I have thought about what a unique contribution this would be if, as you go along, you put in a subtitle, that is a bibliographical reference right in the film to refer to section so-and-so of this monograph--for the participant so that you carry him or her along in the film to the research publication. I don't know of anybody that's ever done this. But, I believe that through a combination the art of the film by the faces that we have here with the ideas that have already been generated plus the fact that the monograph is to be published that there is a great opportunity to make a significant contribution in the area of creativity in a form such that it can be shown at every audio visual conference in the country, every state teacher's convention in the country. It could be disseminated widely through educational television and there are other outlets too, that I am sure it would be useful. Now this is not outside the purpose of Title 7. We know that under Section B, Title 7, there are funds available for the production of demonstration films of this sort which have not been too widely distributed. We do have one, pardon me for mentioning it, on inter-institutional use of television at the college level so that there is a precedent for this sort of thing. I think it would be a glorious kind of experience if the monograph was developed at the same time with supporting media that could be produced with the idea of giving this the widest possible dissemination. Now, my concluding point is, I believe this is necessary. I believe the level at which we are speaking here is a level considerably above most school administrators and school teachers, that many of these people have not even recognized the problem. Many of them don't know really where to go for information or what kind of information to seek if they do recognize the problem. If you don't believe this, just look in the Handbook of Research on Teaching and look under the heading of creativity. About the only thing you find is some reference to Penn State and the teaching of art. It is an extremely barren document with regard to the whole subject of creativity, and I think, therefore, for your own salvation, for those of you, and I would like to include myself in this, who are interested in the topic of creativity, that something rather unique and creative be done in the field simply to sort of sketch out the potential in this area.

C: To elaborate on the idea, you could have three films. One dealing with the available, already modified things that have been produced; the second one on those that

8

can easily be developed from the basic research that has already been done; and a final one on research needed.

C: Yes, you might want your core film, your nucleus film, and then you could produce such satellite films along the way as you want to in a sense complete the universe of creativity.

C: You could use some of those film clips that have been shown how answers get closed up instantaneously and how the film would be different if it were stopped and viewers were asked to answer the questions for themselves.

C: Surely, and reference it all to your monograph. There's the basic document anybody can turn to.

S: Now our experience with our materials that we have produced during discussion form is that these are all self-propelling. People do read them and they read them with great interest. It is almost beyond the natural way things happen, like the mathematician talking about discovery methods. I would bet that the discussion here would be just self-captivating. If it has kept the attention of these kind of people we have here around the table, I think it will capture the attention of a lot of other people.

C: It seems to me that there are some merits in this idea that we are not beyond showing our faces, as it shows our doubts and so forth. I think that we have come up with some constructive principles that we can stick our neck out with and illustrate. This film could discuss the principle you know and make it pretty plain and clear what it is, what evidence there is, and what risk there is. For instance some of you have evidence on new questions, entry questions, divergent questions, etc. This can be illustrated very plainly and clearly in classroom study. .

S: I think he has explained the big idea here, and I would like to then start tripping off some other ideas. One that kind of occurs to me as very straight forward is that some one or more humans, some effort, could be put to the kind of thing that Beck has done which is to go through systematically all available film material pulling out those parts which already are in form or could be easily modified so they could be used. I think some human effort on this would be a rather exciting adventure in the report of how hard it was to find what few scenes or film sections are available to do this. The nation has spent so many millions of dollars on such and such film projects and only one thousandth of one per cent is convertable to use for creativity. This is about as beautiful a demonstration as we can get. I think some human effort should be made on that and even looking across textbooks and other media that are currently being used. Our little daughter said she has gone to the library to find the most creative books she could; and she came back with only one book that qualified this way. Well, I'd like to have her go maybe and find all the books that are not creative; and I'll bet she'd come back with almost the library.

So, I think some human search, some human efforts, could well be done on this and with some guidance occasionally as to how they would need to be modified.

C: We have been working a lot of our spare time on this New World Foundation contract. They gave us $5,000 to evaluate some of the current applications of creativity research and material at the elementary school level. That's the reason I've been digging through new books and a lot of materials like that. I have several suitcases of these; and in a local area, whenever I am asked to go out to one of these workshops or something, I take one of these suitcases out and leave it in the principal's office or in the library or some place and ask those who are interested to browse over it and experiment with it and to write an evaluation report giving the ideas that they have of how these materials could be used. I have collected an amazing stack of them. Many I think are brilliant ideas coming from teachers about how these materials that are already in existence can be used. We've got so much data that I haven't had time to write the report on it.

S: This is a new variation. As you said the teachers are ready; all you have to d is turn the existing materials to them and let them give them the proper twist.

C: Yes, with that kind of stuff and with an experimental attitude.

S: This is a second kind of effort. I can sense that in such a proposal it ought to have access to at least one creativity researcher who has a good view of the field so that when teachers come up with ideas they can check and see if this tends to square with at least one researcher's thinking. Another thought then beyond this is that some of the material that is already available to creativity researchers which they have been producing could well be considered for more widespread dissemination. We have had a variety of materials that are already available. Could we, I don't just say disseminate them and give them away, but they could be placed on some kind of demonstration or development checkout. They could be very widely used under some kind of contractual basis to see what differences they make and reactions to them. How well they can be used by the teacher and their reactions to them, and so on.

C: Another idea would be to identify at this time the books and materials for teachers who are operating creatively in sustained ways. If media men could be put next to the teachers behaving in this fashion there would be a natural context for the development of media to serve such functioning. I'm thinking of Daniel Barken's book in which he spent about a year locating creative teachers from a wide scan and then he prepared a book in which he tried to reveal what these teachers were doing. In other words, I think it is feasible to undertake the location of such persons. Also a reservoir of the names and locations of such persons would be useful for instructional media people to try to team up with.

C: You may want to create a film to be used for teacher in-service training to show teachers what these identified creative teachers are doing, and how it is done in their classrooms.

C: To form this list of creative teachers would you just pick up those who have already shown creative teaching in colaboration with instructional media or are we leaving that entirely aside and only list teachers who have been identified as being creative?

C: I hadn't thought of these two types of teachers.

S: What's your experience on this Dr. Hughes? You've studied teacher performances. Could these teachers be spotted and do some use instructional media and others not?

C: Well, I think they can be spotted. I haven't examined this from the standpoint of using instructional media, but they really aren't very numerous. It's a great deal of work to identify such teachers. In our study there was only one teacher who taught in ways that the youngsters gained in any superior fashion of the four or five creative outcomes of education that he was testing. I think in terms of creative interaction.

I think in terms particularly of such things as building independence and autonomy and the teacher building confidence in the student. That is I don't see how he can leave out these basic qualities if we want to foster creativity. We have to interact with the students so that these processes are allowed to emerge. This can be caught in the few classrooms. We can teach them creative responses and encourage the child to go on his own way instead of intervening and deflecting him.

C: May I comment on the point of dissemination of innovated practices for classroom teachers. We have the inhibiting quality of the institution to deal with if we are talking about getting into the public schools and changing practice there. Now I had an occasion to talk to about a thousand teachers yesterday, and I took the liberty of just briefly talking about the sort of thing we were doing here. I wanted to get a little feedback right away. And it was perfectly clear to me from the kinds of questions which were asked that teachers feel the need to become personally involved in this kind of thing. They don't want the administrators to tell them how or when or even why. So I think anything that we do here that gets right to the teacher, under the skin of the teacher, will take effect. Things that have to go through all the institutional interference and layers of the onion may never get down to where they belong.

C: But I don't think you can bypass the administrative structure. If you do, there is an insecurity there that these teachers will never overcome. I think this has been pretty clearly shown.

S: You've got to educate the management first before you educate the teachers on it.

C: No, I don't know about that. Maybe you've just got to get agreement from the top that this is alright.

C: Well, I think I can speak on this because I have worked for many superintendents on many projects and have consulted. I've worked for many superintendents who didn't really understand precisely what I was doing and who never bothered with it. They presumably had confidence in me and the teachers who were responding so positively to me that I was allowed to work with whatever schools had been designated very very freely. Then I reported casually to the superintendent. But I wouldn't say that they had to give permission to the understanding of the ideas or the changes. I think this is an important distinction when we talk about it administratively.

C: It is important for the building principal to be involved.

C: Yes, you can work well if you work in the building where the principal is involved. I thought Provus was correct yesterday when he said: "Pick a building." When you are talking about changing or working--use the whole building.

C: This was the informal conversation we had about the Time to Teach Project. Our center of attention is the building as a unit.

C: It seems to me from my experience that it is very wise to work in a building. Hilda Taba in her work will go so far, and I don't do this to just take two or three teachers who are responsible to her, and the rest of the people in the building are ignored. However, I always try to incorporate the total building because then I think there's more support and my experience indicates this is better. There are different ways of doing things successfully.

C: Our worst failures have been when we worked with teachers that we had encountered in city-wide workshops that had the high and enthusiastic reception of the city-wide administration, but the building principals were not involved. They volunteered and they were eager but they didn't have to. These teachers did more of the experimental things and they went back and the building principal wasn't in on it and they were scared to try new things.

C: I think the total building working with the principal is a new technique for working on a project.

C: Could we go back over this idea of trying to put on the screen creative teachers? Didn't you find Dr. Torrance that certain teachers produce creative products or creative individuals and other teachers did not? Would it be possible to capture this on film, the differences in the way they behave? Now I am sure that the behavior is not uniform between one teacher that developed creative products and another teacher who did not. Can this behavior be captured on film?

C: I believe it can. You would probably have to shoot more film than you need because the teacher has to warm up the process. It is the kind of behavior that isn't the easiest to stage. In constructing some films for use in our undergraduate programs an effort was made to show excerpts from language arts, literature, and so forth; and I felt that this was a miserable flop. Other films came off pretty good. So you get a fairly good batting average; but when you try to stage it, you are running a big risk there; but you can get it as it unfolds naturally. It is the kind of thing that I have tried to get by still photographs of children in which I could capture the essence of what happens when they play creatively. It is the kind of thing you can't possibly pose. But if you get it going; the kids don't even know you have taken pictures even if you use a flash bulb.

If you take the pictures back a week later they will say "I didn't know you took that," because they were so absorbed in the process that they didn't even know it.

C: You may even have to use a candid camera technique. We ran that sort of thing on our last San Jose conference. We tried to stage by closed circuit television some canned creative teaching for the people in the audience; and it went fairly well; but nothing like the natural classes would be.

C: Well, I had the impression that someone went over rather casually and watched a creative teacher and in a very short period of time saw what would not be called creative teaching per se; but saw what would be called all of the techniques of teaching displayed.

C: Yes, there is a wide range of teacher behavior.

C: So that if you really spotted some of these teachers and went into their classrooms two or three times without your camera set up so the teacher and the students get used to this and then turn the camera on you might not zero entirely in on creativity but could show teachers using a wide variety of techniques some of which would foster creativity.

C: I think that the teachers by working with the teachers they could predict reasonably accurately whether on a particular day you'd have a pretty good chance of getting this kind of teaching in the natural course of events. I think in my own teaching I could predict certain days no matter how I try, that the class is not going to come off very well, and other days when things have been built up or I am warmed up and the students are warmed up, and so forth things will go well.

C: Except would it be too expensive to put a crew in; and if nothing happened, take nothing and come back another day?

C: I don't know but the film seems to be a minor cost of this whole operation.

C: In other words your production crew is the more expensive part of the operation.

C: Well, we made some situational tests and we shot 6,000 feet of film to get about a hundred feet of usable stimulus material, and I didn't feel too wasteful because of what we got from it really produced something for us.

C: Well, if you look at it in terms of what's already been produced we've just got reams and reams of films that have been produced, none of which are useful.

C: That's right. And I'd like to put in a plug here for using talent who are knowledgeable in film production and knowledgeable and confident in the film medium. This is no area for amateurs to be let loose on. The amateurs can do a good job of recording what they would like to have shot, what they would like to have incorporated in the film. You can go in ahead of time and you can cover the action and say this is what we want captured. But when it comes time to make your finished film, you realize that a film like this might be seen by literally millions of people, you don't want anything mediocre. You've got to pay respect for the film medium. It just has to command respect. And there is no substitute for a creative director in a situation like this. Now, he takes and directs his crew in ways that you get a symphony out of this, and you don't have a bunch of people playing at loose ends in this scattered orchestra. If a film like this is to be made, be sure that you appropriate enough funds so that the final product is a tribute to what you want to disseminate. This is not something to be distributed in hand written form. This is a publishing job really and there are people who are highly talented in this area who can come and help you. Don't try to do this yourself. The results will show it.

S: One of the messages I have is that there really is not much being spent in the area of creativity, neither in research funds, implimentation funds, nor operational funds; when at one time in history this research was emerging. But there is a lot being spent on some other things that are emerging in the same time in history which are producing gadgets. So I make a plea for what I call equal time for other things, for equal effort. Now you can say it the way you want to say it.

C: I think that had to be said. I was also going to comment on this film idea because I have had a wee bit of experience and I am very interested in the production of films that will aid teachers. I think that teacher-training is probably one of the best payoff areas that we might have but it seems to me that we have to break it down a little more. We have to take classrooms where teachers are working with youngsters creatively, and the youngsters are creating with inputs so that you can see the certain kinds of input. Now, I am thinking of an example from a first grade where the teacher had brought in sacks from the plastic ends of hypodermic needles and the children were given these during the last half hour of the day; a handful of these plastic needles or rather plastic covers. In thirty minutes you had a great diversity of most interesting, most concentrating work on the part of youngsters, and then the teacher took their oral expressions when they wished. Most of them wished to tell what they had done. A picture of the classroom at that time, a picture of the "product," of the youngsters, a picture of some youngsters who shifted from one idea to something else would make a fascinating film. All of this zeroed in on how the teacher looks at individuality. You see what I mean? I could go on but that is probably the best illustration, but I could go on in a half a dozen areas.

C: Another illustration is that I think of things that show process. One in a series that I am very proud of was in a first grade classroom the first day that they got their rhythm band instruments which was just a bedlam. The teachers learn by experience that there is nothing they can tell the children about these instruments this first day. They've got to smell them, they've got to feel them, they've got to rub them, they have to encounter them creatively. Then near the end of the school year they get them where a little midget of a first grade girl can stand up before the class and make music.

C: I was even more impressed though with some other materials which are able to show this kind of process not in the creative arts but in the subject matter fields which is so important to the academicians who still pretty much run the school. If we can find some way to analyze content in terms of process then maybe if we could turn loose some people and money who try to develop materials that show the creative process and the act of creativity in the areas that the schools emphasize.

C: Some of these problems you're talking about could be dramatized just beautifully. You could dramatize that rhythm band and other things being done all the time that could be captured easily on film.

C: I have all kinds of beautiful content episodes that gives one an opportunity to go in a creative direction.

C: I have two kinds of wild ideas but one may not be too wild. We have a form of process here in our own tape recordings of this conference which have educational content in it. Tapes are much cheaper than films and excerpts could be made from them. I'll bet just by our typists telling us when they hit a few pages that they really got excited in would be worthwhile material because typists are like more the public at large. I hope they don't get mad at me; but they know what the public really likes; and they could get these excerpts and we could put out an hour's tape which people might sit down and really enjoy listening to because some enjoy listening more than reading or seeing. Now I've got another wild idea and you might shoot me down on this, but I have had exchanges with Hollywood groups, one named Saul Bass and another person who came here to listen to my speech once and they came up afterwards and we had a real live discussion. I wouldn't doubt at all but what there are some people in these circles who would almost volunteer some free effort to make a dent in the school system in the nation for a thing called creativity. There is just enough interest that I'll bet you could get some of their resources to team up with.

C: That's the kind of people to work with.

C: I did think this was so.

C: Not on the whole theme though. I think they need a lot of help on the input. They may be good on the technical part. Even the interpretation of the input requires more than just a technician.

C: I think many of them are sufficiently interested in human characteristics and this magic word of creativity and in working on it they would come out and help on it.

C: If only you could get the crew that produced all the material at the Eastman Exhibit at the World's Fair. That is Saul Bass, Sie Wersher, Roger Barlow, Dave Shores, get the whole bunch of them to work on this.

C: Get industry to contribute people to this.

S: There's another thought I have going back to the specific inputs and outputs. Again I am talking for myself alone. I like a film that depicts natural events like science as a relation between how man does things and how the events in nature actually are. I don't want man to intervene. I just want the natural experience.

For example bring in some natural exhibits by presenting raw phenomena and that kind of stuff or raw data of nature including maybe human nature, showing pictures of strikes and some things in society that have happened. Just give students a feel of the raw data and let them build their own interpretation and evaluation from it.

C: I wonder if there isn't a lot of stuff available in the commercial discards, too. I don't know what happens to all such films but they have excellent photography sometimes. What do they do with all the old films of all kinds? If somebody could search there there'd be a lot of stuff that would fit in this way.

S: Well, I wonder if anyone else has some ideas. Maybe we could go around in a circle here and mention some things that are available or easily modified or kinds of things that could be done which the Office of Education could seriously think of doing. I think also of this notion of books. If any of us have certain books that we could point to as examples. Maybe our own monograph is what we would call real live material which gets people to follow and get involved in and interested in which shows the cross fields of creativity you know sometimes where people don't roam. It shows fascinating areas to work in.

C: Well, I have been thinking of the very short and revised b ok that came out of the Woodshole Conference by Brunner. This was a conference similar to this only I think it was in curriculum. Could our report come out in a very short version for publication on this Conference. Call it, "The Torrey Pines Conference" or whatever you want to call it.

S: Well, I would vote for getting the full monograph out first and seeing there where we go.

C: Yes, it would come from that.

S: And it may be that the full monograph won't be so full that it needs to be too digested. What you're saying is a widespread publication.

C: Yes, increasing the possibilities of being read, because Bruner's little book came in circulation as a best seller.

C: Yes, and it was only 80 pages.

C: I can see it now, "The Torrey Pines Report."

C: Is there a repository bank place that can receive what we send and what other people send in? I am thinking particularly of Barkins' effort to capture with the recorder and with the camera and catch the dialog and so forth. I would like to send this to somebody who could act from that point on. I wish there was a bank that could receive my deposit. Now do we have such a bank for creative materials?

S: When you pick up an idea or a sample in the next few months where can you send it?

C: That's right. And I can keep on producing samples and ideas if I have places to put them.

C: You mean further ideas along these lines?

C: Yes, or materials or anything.

S: What you're saying is what if you see a film and you feel that this is really the kind of film children could create from what can you do to tell others. The one I like is the Rand film about how man copes with the polar regions. You see, the kids in school would be delighted with this content, just showing what life is like out there and what all the raw materials are like and what men can do.

C: I wish it were possible for you to see those films that he is talking about. Most of them are classified as secret, but they show some developments in the physical sciences that are almost beyond your present imagination. Talk about creative thinking. The people that think up some of these things are utterly fantastic. It is beyond description.

S: You sit there for an hour or two and watch these films and your imagination's tickled the whole time. Except that occasionally you hit one that's so exciting that you don't watch the next one.

C: You black out.

C: Well, the audio visual or the mass media people have some national associations. I have two possible suggestions: have a group in that association that could become this repository place that you're talking about; and number two, if that organization could undertake to conduct conferences in the specific different medias such as; programming, textbooks, films and so on, and invite in some creativity people or I am sure there are creative people among the media people too that could pursue further some of these things along the specific lines of the particular media.

S: I think what we are talking about is a small alert bank of special clientele not an ASTIA that will get swamped after a while and you kill it if you stuff so many things in it. One that's looking for the real gems, and as people run in to them they send them in; and there's some chance that someone's going to do something about these to make these gems widely available.

C: Is there somebody or some department of the U. S. Office of Education that might serve this function?

C: This is possible.

S: Could you send ideas to them before they have the machinery to handle it?

C: Well, we are now developing or working on information stories in retrieval systems and this is something that I would be very happy to explore because there is a possibility that we could serve this function. Perhaps realistically serve this function.

S: This should not entirely be a storehouse but really a dissemination center or agency.

C: Well, this is what I mean, information storage, retrieval and dissemination. You see this is the next part of it.

C: I would hope that media people would not be charged with this responsibility.

S: It almost should be a new group. If it is not a new group this function will go into their old system and get lost in the big shuffle.

C: This could be followed up with the notion that each summer there would be a week or so when you would get the persons who are possibly embodied in the most fruitful things together and could have them meet to have them share with one another and realize what their contribution could mean so that you follow up with questions.

S: There is a side comment I want to make. The National Research Council holds conferences like this just for the sake of the effect they have on the people themselves not for anything that spreads out afterwards. And one of the real merits of a thing like that is that some of us have met together before and we have brought new groups in. We have reached the point now where we can talk freely, but we profit a lot from exchanging ideas with each other. There is a handful of people that are finding this is a tremendous experience and at the same time we loosen each other up and interact with each other. Take the example here where we have media people learning about our intensive research for a period of time about creativity which is going to certainly have a lasting effect. They're going to be influenced by this experience in everything they do the next year or so. We are going to capture them. Not just capture them for two, three or four days, but you've captured them for their full career.

C: There's a place in the USOE under our talent development project for this work. I believe I could get some staff assigned to it. To do this very thing, and this is something we might explore.

C: Well, here's one quick thought which may be worth something. The National Society for the Study of Communications is a young off-shoot of the National Speech Association. Here's a group that has a creative thinking committee which was just started in the last couple of years. Here's another potential feed-in source or feedback source for creative ideas and materials.

C: I was just going to say let's not forget books as potential media devices. My comment is going to tie up with Paul Torrance's reported experience. It seems to me that the books available for young children in this country are not really designed to foster and stimulate their imaginations. They are always too close to reality even though there may be some fantasy in them. This summer in France my wife and I were fascinated and intrigued and fell in love with the little books which are available there for children. You can buy them in the five and ten cent stores in France for one franc, about children, about animals, full of imaginative and colorful things. I think that we have got to somehow encourage some kind of atmosphere whereby we can let our fantasy grow much more freely and much more widely through such books. These little books are available and they could only be translated into English or little films made on some of the ideas. I think they would be tremendously stimulating and provocative to the fantasy of children. If you go in this way it does seem to me to stimulate the capacity for analogical thinking, similes and analogies that I was pointing to in my paper. It is very depressing to me to see the kind of books that do get published for young children. My wife is a novelist. She has written several young children's stories which I think are beautifully written, tremendously imaginative, and they all get turned down because they are not close enough to reality. We're bucking the culture here, but what can we do about it to get an environment where we can tolerate more fanciful thinking?

C: Have you got a sample or two?

C: Well, no not here.

C: That's true also in the film world. The French have done some beautifully stimulating things with films. Take the film, "Martin and Gaston," I don't know whether any of you have seen it, but this is a film that was made by children and in the credits they list Henry, age 6; Susan, age 3; Peter, age 7; and then they get down to Renie, age 36. He is the camera man. The whole thing is just a delight, the sheer side of fantasy in the technique.

C: Well, I know what you can do about it in this sort of thing; you could just sort of buck the tradition.

S: Right, and the kids if they get a hold of this stuff display their reactions to it which might almost be self-propelling.

C: I have another kind of an idea which will take us off at another level. There are two technical points that I wanted to make. The first one was that I have recently attended a number of these kinds of conferences where you almost hear the testimony of the development of an idea. We went through the programmed instruction idea and then the systems approach to the whole concept of learning and then all the computer people began testifying how this was going to solve everything. We recently had conferences on the acceptance of innovation with all its enthusiasm. I must admit that I now feel a little like everybody is giving their testimony such as all of you who have spent years in this field. Some of you were talking about different styles of media presentation. I said that after listening to everybody else I felt like I had no style at all. I felt very negative that my paper was critical of existing media. I have thought about it now and when we are talking about all this constructive, creative kind of action, I wonder about the role of bulls like myself that come in among you flowers and ask what is the role of the instructor, the critic, the condemner,, and all that sort of thing? I think that there may be some purpose in getting rid of that which holds us back and of criticizing the status quo. It seems to me that the conservative is the one who sees the good in what we have and wants to hold on to this as his role. But it seems to me that the liberal, the one who is critical, who wants change, who sees the present as being not perfect, has a role to play also. And I think that somewhere, somehow, consideration can be given to this getting rid of the chaf, looking at the real solid parts of things. We should begin to look at what's wrong with what we have.

S: Can I comment on that? I don't think this is different from what I was saying about tradition vs. innovation; that we should expose students to both somehow in our instructional media, in our practices, and so on. Do we hang on to what we've got, or do we take a new step, or a combination of these in terms of everything that's going on. I think that there is some evidence of this in Al Wight's work at Aerojet. When he tells someone to play the role or devil's advocate then this person becomes not too highly liked. But, when you check afterwards, he forced the group to do more thinking on the problem than they would have done otherwise. They do a lot more thinking than if he weren't present. These demonstrations are good demonstrations and again could be incorporated into instructional media. You could give a film series in which there was no devil's advocate and another in which there was and find that the second one forced people to join in thinking new ways.

C: The negative side of this must be continually brought up as the thesis and the antithesis that's going to eventually move us forward in the field.

C: One idea that I've had in mind is that I'd like to see a film or tape, or this could be presented by any medium to show the difficult situation in a classroom wherein creativity is possible but is also very difficult for the teacher to allow so as not to endanger things. I can't think of a specific example, I mean is this clear enough without a specific example?

C: I'd like to use one example. It is kind of general I guess, but I think it is something we should bear in mind when we're creating various instructional media. One of the characteristics in the life histories of one of our highly creative persons was the rather unusual trust that the parents had in him- -confident in his abilities and what he could accomplish so that he roamed much more freely, much more independent. I think that in our culture, in our society, in our schools, we tend somehow to underestimate the individual's potentialities and capacity. I would like to see some kind of assignment which would encourage teachers to stretch the minds of their children rather than feeling that they always have to play them down and give the simplest kind of presentation. I think if people are going to be creative they have to be challenged. I think if they are challenged they develop this kind of intrinsic interest that we have talked about around this table. I would just like to get this read into the record. It is important, I think, that we respect the child and the capacity and potentiality of children in preparing materials for them.

C: I should like to add an additional comment. I recall a very innocent incident that was given to me by one of my students. The feelings that this person had in the school where she was when she had volunteered to serve as the counselor for a special interest science group. She felt tremendously discouraged when she appeared at the first meeting of this group and found that she had fifteen of the lowest achieving youngsters of the whole school. She accepted this as a challenge and a tremendous thing happened. It changed the school careers of some of the children because she decided to go ahead and play this role with them if they were interested, to show confidence in them just as she would have treated the 15 highest achieving students.

S: One leading company in the nation which has an unusual percentage of good ideas says that every so often you should give every employee some challenge such as not what he can now do, but something that is beyond his present ability so that it will tap his development and his potential.

C: I'd like to go back and comment on a past remark. It seems like most training films that I can remember always have a happy ending, a successful type of thing. Perhaps films ought to show a teacher where she has failed in trying to evoke creative behavior and then take up a discussion of why there was failure.

S: It is a growth process and it doesn't always work.

C: Or students aren't ready for this type of learning.

C: I think much of this thing we're talking about now stems from the value we place on success in our society, in everything we do, by teachers, students etc. The innovator must be successful, too, which is impossible. Therefore, why don't we have some instructional materials which emphasize people's failures?

S: And then show them living through failures.

C: Exactly. I have seen some very funny excerpts from old news reels on the ideas and failures of flight. You must have seen them. They are a riot. You can talk about the inventor carefully working out how you can fly if you have six wings flapping at the same time, you'll fly and, of course, you don't. You could do that in every one of the subject-matter areas.

C: We are talking about innovating and demonstrating; I think we have strained the medium there enough and our imaginations nearly enough. You could mix together all sorts of wierd things, I believe, which would be very stimulating. Let me return to this business of reformulation from an internal base. That is the notion of how you can get outstanding teachers. The nice thing about Socrates, after he had knocked the other guy down, he turned around and knocked himself down. This kind of behavior is sometimes difficult in a way and not just a spectacular at the moment, or the type of thing you could put together with film clips.

C: I think I just have to hitch-hike on that. What if you used a forced relationship technique and you picked a biology film and gave it to a geometry teacher and said, "Find a way to make this useful in your class." You purposely tried to just do some very completely different things.

C: You know, I really think it is possible to do much more of this than we do in our classrooms.

C: Maybe teachers would find this would stimulate creativity ten times better than any film they are using in their classrooms.

C: We are leaving Frank Williams with a big job to do, and I am sure that he will do a very good job, but with many limitations that he has to work with. I think that we have got something started that needs some follow up. One of my suggestions would be to develop something that would give Frank more time through U. S. Office support to follow up on some of these leads and ideas that have been developing and getting organized a bank or depository, or following through some of these other ideas.

C: If he could get some additional support to take the initiative lets say to send a round robin brain storming memo so to speak, to us once a month or so and everyone jot down their ideas that had come up in the mean time. Take this thing away from just a chance feedback and put it into a deliberate feedback mechanism.

S: He could just send a device every so often so that if you have got anything you can return, if you haven't, you don't have to.

C: Or, say you've got to have something. How about once a week?

S: Once a week is that all right. Is there anybody here who can't think of one idea a week? It wouldn't be hard on us; it would be hard on Frank; let's hire a secretary.

C: I'd like to emphasize the individualization of present media. In some way I would like to see the Office of Education or someone develop the kinds of films we have been talking about. Open-ended kinds of films in eight milimeter, small, short things which can be used by individual students.

C: Is this the single-concept film you're talking about?

C: Well, it is for individual study, and in many cases this could be around an individual concept. I think in many cases the film might present a situation or a small piece of life in the raw like a winter scene or something. I don't know what, but a variety of things that individuals can use and move on from there.

C: But, with very careful rather narrow objectives or even a global thing if the objective is for the individual to dig in. For instance, take a winter scene, and I don't know why on earth I chose that except I had it on paper here but suppose I take a winter scene for instance in the mountains. The film could pose the question, "How would you feel if you were there." I mean this is a single kind of thing, but I think that we must move toward materials that can be used individually that can be plugged in by the individual. If we are going to nurture creativity then it means that these things that we put in don't restrict the individual. This isn't just used in biology, or this isn't just used during the reading period. In some way it is something the individual can plug in and use. Now I think that's extra ordinarily important.

C: Can we say that many of these materials now exist and that the only thing that we need to do is to identify them and put them in the proper place?

C: Well, I don't know enough about all of the media available. I know that we have many excellent film strips particularly in arithmetic which happens to be where I have experimented. These you can get for individual viewers, and they can be used and have been used most successfully.

C: Aren't you suggesting that we might find such sequences also in commerical 35 mm film and you just need reports of them and where they are used?

C: This is what I am wondering. Is this something that we need to do fresh, brand new, or is this something that exists? Do you have some ideas on this?

C: Teaching Film Custodians is an attempt on the part of a group to recover some commerical film and which has educational significance. There is a tremendous resource there of commerically available material. Now how they could be utilized, how you could extract them, and how you would survey them I suppose would be a matter to discuss with TFC.

C: Well, this is a process of utilization more than production. At least the utilization element is in it isn't it?

S: Yes, this is true.

C: Then, I think that maybe additional suggestions could be made for the use of recorders. One of the things that several schools I know have found stimulating has been to get a pen pal in other countries, and then the pen pal instead of writing has corresponded through recordings. They are recording on little tapes or little microfilm or what have you; and these have been very successful. Now it occurs to me since I have noticed that children learn when they talk about how they do thus and so that I think we might experiment with children recording their own processes, their own reactions and other children could listen to these. I suspect that even with adolescents this could be brought to quite a high art and very useful as adolescents have such an effect on one another. In commercial material we need to have a list of things that have been extraordinarily good, that ought to be made available to schools.

There is one other thing about creative behavior in the classroom and that is that when a child behaves creatively, by definition, he is doing something new and different. I would like to call attention to the surprise that it elicites on the part of the teacher. In some way we will not have creative behavior fostered until teachers learn to handle that surprise. Teachers are often taken off base whether they are teaching algebra, whether they are teaching arithmetic, or what else and here comes this unusual thing.

Most teachers according to our transcriptions respond by immediately restructuring the situation back in the most narrow way possible. And when I have queried them on this and when they have reread their transcripts they will always say, "How come," or they will say, "Why do you suppose I did that? Wasn't that awful?" And then they say, "Oh, I remember how I felt, I was so surprised and I thought, 'Look, what will happen if this goes on!'" The new structure is even tighter as we go back and look, even tighter than the original. So let's not underestimate the job we have in getting materials and using materials that allow for classroom creativity. But it is also allowing and building up the maturity and the experience of the teacher to accept creative behavior.

C: I think a film illustrating just that might be very valuable for teachers to see and experience.

C: Well, I don't know why we couldn't have it. You could replay some of the episodes for example that other researchers have. We could restage the episodes almost right to the tee that we already have and demonstrate this behavior.

C: You raised the question about the availability of commerical footage especially that in the 35 mm size. There are very severe restrictions on the use of 35 mm film out of Hollywood for very good reasons. They are interested in making as much money out of this as possible, and they have set up this operation of Teaching Films Custodians for which one has to pay a sizeable amount to use those films. Now it might be that, if properly approached, TFC would be willing to do a supervised editing job of suitable materials if they are available. But, there are complications for the use of their material.

For example, you can't buy, you have to lease and leasing does amount to about the same as buying, but some business managers aren't interested in leasing for life; they are interested in buying. And then, too, you don't have as much flexibility in working with them. It would be possible to do a little search through 16 mm fields where there is an increasing amount of fine material becoming available. For example, the National Audubon Society is developing a fine library of materials that their national lecturers use. There is some very exciting material that I have seen of Doctor Allen's for example from Cornell. There are reservoirs of footage that's available. National geographic also has quite a library.

C: National Academy of Sciences has listed all the professors around the country who made films of fantastic things. I don't mean to discount the value of Hollywood potential but I merely say that their operation is strictly a commerical operation; and if you don't believe this, try to get a little footage out of Disney other than what he himself edits. It is impossible. I have just one comment in addition regarding a comment this morning about a system will regulate itself if sufficient feedback is provided. If there is anything that the audio visual field is suppose to be able to do is to capture and provide feedback so that people can see what is going on out here in the periphera of knowledge. I would like to see that idea explored some more by what the audio visual people can do to capture what is going on and provide feedback to those who may not be engaging in this activity or for the active person himself to be able to see what he is doing. This seems to open fantastic vistas if this is a true statement that the system will regulate itself if sufficient feedback is provided.

C: This is the belief of the systems people anyway.

C: This is the self-monitoring system.

C: I have just read a research report on this in Speech Education; just the kind of thing you are talking about. And after one showing the groups could be identified who had had the opportunity to see themselves. Their posture changed, as a group. The other group was the way they were before. The group who had seen themselves were actually so different after one experience of seeing themselves in that context that they were identifiable as a different group.

C: There are basic psychological phenomena involved here under the studies done at Harvard where they paid delinquents just to listen to themselves. This supposedly transformed their behavior quite a bit.

S: Well, if I may go around again on development efforts as to what could be developed. Can we get ideas about things within reach almost to start working on developing activities. Before I do it I want to read a couple of things into the record. First, I think this last chapter is the one which will take some re-organization because I think that all the others are fairly natural. But I think that this is a re-organization problem. I think it also might be a good point in the preface to talk about styles of people, presentation, research, and so on, and the interesting variety we have had here in the preface of the conference report. Another point I want to make is to get an introductory statement in this chapter which indicates that we have not patterned the last chapter too tightly because we hope people will read the previous chapters and get ideas on their own. We want to save this for the reader of the report so that if people get better ideas than what we have generated from other sources or from reading our stuff these too should be welcome. This has been a healthy thing in our creativity research so far because we have such a proliferating field that it is hard to get control of it in order to get it crystalized. And I think that it won't crystalize prematurely. I think it is helpful to keep it broadly opened. To turn to some of the D's or some of the quick thoughts I have, I would like to see more attention on process of students. The only example I can think of, or the one example I can think of is to turn to films. I think Suchman has examples of kids asking questions which was a real live discussion showing the student coming in and taking over the classroom and just asking questions. He had an interesting kind of a situation where some of the teachers asked, "When do you answer I don't know?" And this may be the hardest thing to teach teachers, when to give the answer I don't know. The second idea is to play with this feed-in and feed-back with deliberate attempts to put the responsibility more on students to draw upon resources they already have within themselves, in other words, the walking library, the primitive experiences or thoughts. We need to experiment with the kind of thing where the student not only draws upon his own inner resources, but draws upon what we would call inner guidance, self-guidance. Is that right?

How do we get students to take more responsibility for decisions themselves? You play with feed-in and feedback and so on and they draw upon that. Another idea is a recommendation that someone could well be supported to do a D activity which is no more broad directed no more detail directed than to go through this whole report of things that others are not so inclined to try and turn some of these into instructional media. Now I'll use a very live example. In my experience on writing Clues to Creative Teaching, a follow-up continuation of these ideas in which someone could just take an assignment to go through there and try and turn as many things as they can into live instructional devices. This delayed feedback idea is an interesting one, too. I think some feedback could be delayed and, of course, this could be a research study also. Then we need to look at the question of congruent reactions, what degree can you build into instructional media some kind of congruent reaction? My last idea is to study some of these master teachers and find some of the things they do that we don't have happening in enough teachers and see to what degree we can capture some of this sort of thing in instructional media which we can insert in the classroom to supplement what a teacher does. Perhaps a more rapid way to get it in the classroom is to hope to build all the teachers up to this ideal that others are talking about. It may be possible by instructional media to get students to experience these wide varieties of things that a few master teachers are capable of doing. The reverse of this you know is that any teacher who can be replaced by some of these new developments should be. If teachers don't know how to do the things that they don't do, then we have got a real dilema. So my thought was just reversed. Let's play this other game. Not learn how to match what teachers do, but let's learn how to match what so few teachers are doing and see if we can put that into the system.

C: Well, my D ideas are back at the input end. You should know from the way this conference developed that at the U. S. Office we got some people that we had in mind, and I think we chose the two top audio visual people in the country at least these were recommended to us to come here as audio visual people.

C: You don't have a wide enough sample to make a generalization like that.

C: My point is, though, that we have possible further conferences such as this one with creativity people and program learning people as specialists in program learning, and specialists in educational TV. Now I know that Lester and Jack had worked probably in these areas, but I mean again the experts just as Lester and Jack have come to us today as AV people.

S: This strategy that you are talking about is that you have to invade them almost because they are not coming to us. Isn't that right?

C: This is true. And I was interested in Finn's remark yesterday after lunch. He said, "I was amazed at how naive your creativity researchers were as to what developments we have in new media. This is why he was brought in as a hardware man.

S: We can see the reverse, too, sending audio visual people to see what has been done in creativity.

C: One further thought, you may want to get well-identified people who are teaching by TV, maybe this would be too many I don't know but I am thinking of the psychologist we had in the film yesterday. People like Sanford. There are several others. Have them come in to a conference with creativity people and see how this can be done in their own teaching. We're starting at the top again and hope that this will permeate down.

C: One thought I had is that at our Institute in Buffalo, for example, we could have a kind of a project too that a lot of our people might enjoy by having teachers come there who know enough about media, they are not media experts, and also know a great deal about creativity and think they're teaching something like this.

C: This is a way off idea, but I'll express it anyway. We have talked briefly in this conference about individual differences. I'd like to now refer to sex differences.

I think that we all too often ignore the sex differences. We act as though in education they don't exist. The same kind of education is good for men and good for women and vice versa. It is one aspect of the pressures of conformity it seems to me in our society. I think many of you know of the finding in our study of creative men, that more creative men score higher on the feminity scale of the CPI and the Strong Vocational Interest Blank. Other indicators show that they have more femininity expressed in their personality and the opposite is true for creative women who have more masculinity than less creative women. Now I think that we ought not neglect the possibility of developing different kinds of instructional media for boys and for girls. Some of you may know that Yung and particularly Eric Norman had made a distinction between matriarchal thinking and patriarchal thinking. In our studies we have had q-sorts describing the ways in which people solve problems and work and approach their tasks and we sorted these q-sort items into two categories, those exemplifying or expressing the patriarchal or matriarchal feminine kind of thinking. An interesting thing is if you do this, in the case of the creative women who score higher in masculinity, nevertheless they are true to their sex and they show more matriarchal thinking than the less creative women. I think this expression of the opposite sex in an individual is merely another way of saying that the most creative individual is the person who most fully realizes himself, that psychologically we are bi-sexual. Anyway I think this whole field of sex differences is an area which has been b[illegible] and sadly neglected. I would like to read into the record the need of some kind of development that would differentiate the approach to students on the basis of sex. Now this would be very heretical and be rejected strongly by some, I know. But I think it is worhty of consideration.

C: I can tell you that in Hutchinson's dissertation he found that boys made the adjustment to creative activities better than the girls. As a group the boys became the star performers when you change from what has gone on before to what is called a thinking classroom. The girls did not make this adjustment as well. It is more of an aggressive fashion kind of behavior. We will run into problems if I forecast teacher trends.

C: Well, do you have any clues as to what might be done?

C: They are very vague at this time. I have very much grown out of this problem, and as I get more information that's worth while to put down on paper, I'll be happy to send it on.

C: To hitch-hike on that idea I think it has been mentioned how new media devices should be designed for different IQ levels and I would ask the question, "How are you going to measure IQ's of an audience unless you have a gifted child program or a remedial program and so forth in the public school program?" Now I am wondering in regard to what you said about developing different media for boys and girls if we should create different media for developmental levels along with maybe sex differences. I am thinking of some of the Piaget work here.

C: I think that might well be the case. I suspect that we really require much more differentiated programs, many more kinds of media, many more uses of media, more approaches than we have today, and I think we have just been too global in our approach and our attitude toward the task of education.

C: My hope would be, and I am sure that the audio visual people would agree with me, that we don't throw out a film on creativity or a book on creativity or whatever it is for teachers use. A global type of thing particularly if it's a film. Let's get it at a certain level or develop it for a certain classroom.

S: But can you do this?

C: There are practical difficulties, I mean, if we have to design every educational program for the individual. This is an idea that I suppose is the way it ought to be. But that is something that we can't expect to attain. We will maybe have to think in terms of types of individuals, something of this sort. Maybe I could carry this further. I have been working around hypnotic subjects, our creative subjects and hypnotizing them and planting an emotional complex. Then by suggesting that they all have a dream that night and then the next morning they come back and tell me of the dream they had. Well, the most fascinating thing in the world is that introverted intuitives handled the implanted emotional complex quite differently than the way introverted thinking types do, and they in turn quite differently than the way introverted feeling types do. I have yet to get an introverted sensation type to know how they are going to react. But it is quite clear in terms of the preferred psychological functions of individuals that emotional material is involuntarily transformed, handled, and treated differently. I think that our educational system ought to take this into account. We should know something about the types of our children. But this is dreaming.

C: I feel very much at home with some of the things you are saying about sex differences. If you read child development literature you find that for a long time we have denied differences amounting to anything. But I think the more sophisticated material and the better designs are showing differences. So it seems to me that we have two things to recognize. Training in situations so that the person may become fully functioning, that is, accepting his bi-sexual psychological makeup. The other is in some direction in the realities of what he is going to do. For instance, you're familiar with the need-achievement data and you are familiar with the data on women versus men. We have girls in this great conflict now over career and marriage and so on instead of accepting the fact that if they want a husband then part of the time they have got to act like a wife no matter what kind of an executive they are. Otherwise they won't have a husband very long. It seems to me that these are the kinds of things that women have to be; both bi-sexual and realistically oriented to make the most of ourselves. We also have to be feminine and masculine. This tends to appear both in the materials we use and in the way we treat one another. The other thing I would like to respond to is in terms of styles and materials. It seems to me that we must have more opportunity for the person who wants to pace himself. And pace himself by many dimensions, not only the more difficult material, but pace himself also in terms of working to extend his own emotional output or his own emotional identification. Pacing and digging in must be left much more to the individual.

C: We have supported this in our creative architects. Almost all of whom had drawing ability and skills, but these abilities developed at quite different rates, and the thing that characterized the parents of these children who later became highly creative architects was that they were allowed to develop these skills at their own pace. There wasn't an anxious concern on the part of the parents that the child will at all times be living up to the fullest expression of his potentiality. We found a much more relaxed attitude toward this type of thing among creatives.

C: I would hope that we would develop materials and be much more conscious of the need to work with parents because I think according to the Fells Institute material and some other material that we have that what happens in the first five years is more important than what happens in the next five to ten years even. If we want people to be maximized and come anywhere near their optimum potential we are going to have to be very concerned about these years. Some of our developments and some of our resources must go to work at this early age. One of my dreams is to take a group of parents in their first pregnancy and take them through for six years. This is what I want to do because of the delight they get and the way they change their interaction when they know the meaning of some of the acts of their young child which they of course take for granted. I have done quite a bit of pilot work here, and I have a number of god children around the country, and I feel that this is a very fruitful area to study.

C: May I respond to this? I think you put your finger on a very crucial point. How are you going to deal with this in our study of Mills students graduating in the class of 1958 and again in 1960? We compared girls nominated by their instructors as having creative potential, already shown some creativity, as compared with matched girls who had the same SAT scores and the same field or major in college. And one of the most distinguishing things about these two groups was that the parents of the creative girls were not anxious about their children's performance in school, were not concerned that they always get an A or live up to the maximum of their activity major. But you see we are in a situation where parents cannot fail to be anxious because it is so difficult to get into college if you don't have a very good academic record, it is difficult to get into graduate school unless you have a practically straight A record. And we have some kind of a necessity it seems to me for educating the public and trying somehow to change this concept toward children.

C: Yes, that is true.

C: But you know that you can't convince faculty to select a student with an irregular grade record and let him in when you're suggesting that they turn down somebody with a straight A record.

C: Some of the information on the lack of correlation of grades with work output and so on in later years should be looked at. The evidence is quite clear. One is a study of adolescents. A small percentage of these adolescents were rational alturistic which was their highest type. It was found with those youngsters that the parents had allowed early independence. Parents had allowed the youngster to influence them, that is, every youngster some place along the line when the family said they were going to the lake the youngster said, "Oh, I wanted to go picnic at such and such a river" and the family would change its mind and go to the river. If this was done often enough so the youngster felt he had self-control over his environment and the parents didn't push him, he was inclined to be more creative.

C: I would hope that rather special functions could be assigned to special kinds of people in research. I would like to see the psychologists and the teachers mostly concerned with, as they are now, trying to get good descriptions of teacher behavior, teacher-pupil interaction. And then maybe they could set down to verify a set of specifications for media support. On the other hand I would like to see the media people not concern themselves with creativity as such, for a while. I'd like to see them hold independent of all of that and try to explore all the ways media can have impact, multiple impact. Wait for behavioral research findings so that when the day comes that the psychologists are pretty sure what they need, the resources of technology will be available to fit the specifications they come up with.

S: Well, kind of saying this in a different way, we've had invitations around to try and get ways and means to have teachers join us in this whole search, and you're inviting the audio visual people or the instructional media people to get themselves broadly ready to join us in a whole movement.

C: Yes, while at the same time they very much pursue the inquiries that go on about their present bodies of knowledge and media, pulling pretty close to those deciding points as electronic capabilities, how much can you saturate the field of vision, or what is the number of sensations possible that have relevance within a given period of time. Things relative to hardware.

C: I think it would be impossible to keep the media people away from the psychologists and researchers. There are some who don't care anyway about psychologists and researchers and are going to be exploring these things anyway. They may turn up to be the pioneers in creativity.

S: One of my broad comments, too, is that we want to, hopefully, do all we can to set the stage so progress can occur wherever it can take hold, by whomever or whatever level it may.

C: I have thought of a lot of things because I think I get to D through R my own way, but I do want to say this. I would like to see the media people be as creative as they can with the technological jump. That's one way to put it. But if we are in a culture that can soon afford to give up a luxury of money and a lot of other things, why not? I would like to see the stuff made almost disposable to tell you the truth and deform the sanctity of the audio visual field. What Finn showed us was hardware that was probably too expensive. Our culture doesn't have to be like that.

S: You're going to give all people this used scrap paper that Rogers talked about.

C: That's a good point.

C: I think we have the technology now to make media disposable. Use plug-ins, fill-ins, re-arrange the things, etc.

C: This 8 mm movement and all this other stuff is an attempt to do just what you're talking about.

C: I think we have to look at the texture of our lives, and I think that's what people like artists are developing, new styles. The way we live and the way we talk about the way we live are not the same, and media are upon us. Technology is part of our lives. And I suppose we might as well emotionally invent with it. I'd also like to see more approach in the emotional models as far as identification with these things because I don't know how we can get things to hang together otherwise. You ought to know this in the strict research sense. I think the type of thing I've read the last thirty years, the Darwin stuff is important and we could do this with artists and a lot of other people. It's important stuff to feed children. This is where we get some of the models for how to live and act.

C: Let me see if I understand what is being said for a moment here, what my understanding is. Apparently we have little or no available, readily available, material that will function at a high level in the preparation of teachers as I've listened around the table. You say we should do this, we should do that, we should do this kind of thing--show teachers who are creative, show the process, show this kind of thing. But on the other hand, it looks as though there might be considerable media already available to work with in the classroom if it could be used in an effective way. I think maybe this tells us something about the task before us that we need in some way to use existing media so that teachers can be brought to a realization of what exists and how to use the things we have. Now am I hearing right or wrong in this kind of thing around the table?

S: I have the impression that a few people could be put to work to look across all media and write instructions on how to use it differently or modify it slightly, and we'd get quite a batch of the current stuff to work effectively.

C: But this is to be used within the classroom, and this still doesn't train the teacher.

S: I'm talking about writing instructions, too, you see, which is at least a first attempt at that. You could play with that and find out what it takes beyond the writing of instructions, a cookbook a workbook approach, and so this may be another kind of thing, playing within a developmental program of whatever kind you want, a retooling program.

C: I think sometimes in some cases we must do this. I think eventually you won't be able to throw away the cookbook, but somewhere we've got to get these teachers prepared to do this.

C: May I put it another way? I think you may want to use a cookbook but you want to do a little something more to it, and I don't know what that something is. Yes, you take something out, and you add something to it. This seems to me to be the ingredient.

S: That'll happen no matter how good the cookbook is, the experimental spirit.

C: If we use the recipes then the consequences are there. We either think it's wonderful, or we are likely not going to repeat it.

S: This is one of my latest thoughts to teachers. I don't want you to try all the clues I toss out. Just find one. Keep doing what you're doing all the rest of the time but try this one idea also.

C: But after a while you gain confidence. You're more willing to do the deviation, and this confidence thing is something else again.

C: I think when one has to adapt materials he looses something very often in the process of adaptation. Now I am not saying that you shouldn't adapt, but I think it is important if possible out of this conference that at least one model be developed. It maybe and it probably will be in the report of the conference. That would be the ideal. Anything else which we could do from scratch and building onto it with the finest examples you have is important so that this constitutes an entity in its own right that you can show without any apologies. Then from there you could adapt as much as you want to. You've got to get your central base to work from. On the other side I'd like to speak some a little about the pre-school child. The Office of Education is interested in factors that contribute to reading proficiency in the first grade. We're trying to bring in self-instructional media to first grade children to help them. And it becomes very apparent as we analyze the results that about half of the factors that go into reading success in the first grade are factors that the child brings from home. So the first grade teacher has control over only a small part of the repetoire of the child's behavior in the first grade. And if we want to improve reading proficiencies in the first grade one of the things we can do is prepare the children better before they ever get to the first grade. Then you have the problem that there are 17 million children in the United States between the ages of one and five and only a few of whom enjoy the benefits of a kindergarten so we appeal to the Office of Education to give us a little bit of financial help. Just think of how you could use television for example to stimulate the cognitive developmental resources in pre-school children. Part of our findings, too, show that boys, as everybody knows, are at least a half a grade behind girls at the time they enter the first grade. Boys are very handicapped as far as reading readiness is concerned.

C: But not in concepts.

C: Well, true, but in terms of the resources necessary to learn some of these strategies necessary to learn to read. Some of these children count on their teachers who are also not very proficient. There is an incredible teacher variability in the first grade. We worked with 25 classrooms and it appears that children come to the first grade with strong cognitive skills and could learn to read irrespective of the teacher. It didn't make any difference what type of teacher they encountered. So it's sort of built-in life insurance in the program. One of the things we could do at the pre-school level is prepare the child for whatever kind of teacher the child encounters in the first grade. This is not very nice. I won't pursue that any further. Now, we are presently working on some prototype programs, just blueprinting them for pre-school children, as to what kind of material you would televise for the little kid at home that would stimulate cognitive development and help children develop learning strategies before they would ever get to the first grade or even before they get into kindergarten. One of the things that worries me about kindergarten presently is that as we analyze our data the effects of kindergarten attendance becomes less and less through the first grade. The effects of the kindergarten experience lasts only about the first six weeks or so (in the first grade) so whatever we are doing in kindergarten in the cognitive realm it doesn't last very long in the first grade. We've got to take some other approach.

The last comment is one dealing with the problems we are struggling with in what do you build in these programs to counteract what is presently going on in training of boys and girls at home and the mothering of boys and girls. We don't know enough about this so I am delighted to hear you raise the problem that we've got to look at new data and see what one would televise. And then lastly, if you got children watching specialized programs with mothers and fathers and others looking over their shoulders; and if this is presented under the auspices of the school system, as I think they should be programmed, then follow that. The school should take responsibility for parent education in relation to the pre-school child and bring out the very things that are important so that we get to these young mothers and fathers at the time that they need to be gotten to. You people here are the ones to be doing this. There are 17 million kids just waiting out there for you and their parents.

C: As a media person I can't help but comment on a previous idea of trying to communicate with faculty. If you know enough about the nature of these people who are resisting the facts you could design media that are congruent with their needs. I think that media could help overcome your many problems. I think an example of this is the kind of thing that Beck has done with his inter-institutional television project.

For seven years we tried to convince people that this was possible in our own state. If we'd had the kind of material that we have now, I think probably we could have convinced some people, showed them some things and changed some attitudes. I think, there's a great power in these media.

C: I think media would be helpful but don't underestimate the resistance.

C: And don't you underestimate the power of the media.

C: Well now I didn't mean they couldn't be helpful.

C: I'm not saying that it's a hundred per cent efficient. Media costs a lot of money and we're not willing to put into it the money that it sometimes takes to do a job. It doesn't mean it can't be done. The potential is there if we go to the work and build energy into the media. It's a practical kind of problem. Now on the last point of needed research, we are concerned about programmed instruction. Skimmer made a real strong pitch for programmed instruction in the development area. The question is now are we going to go out and take an idea like creativity and teaching creativity and research it to death before you really have the means at your command to, in the laboratory sense, of eliciting the kind of behavior you want? It may be too early, but I think that research has got a lot to learn about methodology and approach, too. I would like to see some more scientific research be attempted. I can't help but feel that there are a couple of research model theories that are extremely applicable to the nature of creativity. One of these is the information theory model which says in essence that the input may cause any kind of an output theoretically. It seems to me that the information theory model reversed; put around the other way, may be a way for not looking at frequent responses but rather the infrequent responses, as a creativity model. It seems it could be a great potential for this criterion problem. I think that we ought to ask people who are considering research in this area to consider information theory as a real possible useful model.

C: I read your comments as indicating that creativity is an area in which we need to do research, what might be called developmental work in the classroom setting where we try to get the full phenomenon going. Just try to bring to bear all we can in a regular classroom and see if we get the phenomenon going and then we start doing research on that.

C: Yes, you've got to have the development stage first. You don't test the space capsule until you've got the space capsule ready to go.

C: What you're really saying is let's get a whole research process going now and working some place if you can. Get a lot of leverage on it. Not coming in with a single variable but with multiple variables having a lot of leverage.

C: I say let's work on the research and development phases at the same time. Then we don't have to wait for one to catch up with the other. I would like to see basic research come now, too, because, I think we've got a lot to do on research design. I've suggested a couple of designs that could be adapted to the particular problem that I think we're going to encounter.

C: One thought that comes to my mind is the whole matter of incubation in the creative process and what kinds of research projects could be set up. What kind of research projects might be set up to see what effect the media could have on providing for effective incubation in the creative process.

C: I continue to feel that we don't give children as much as they can take. I think we don't know how much they can take. It seems to me that this is an area for research. I know some research has already gone on in this area, but a lot of the work that has been done, although not directly on this point, seems to me to suggest that we don't put enough in on the input side. This seems to me an important researchable problem but some people have research on the problem with the idea we're giving too much; we ought to simplify. I stress the other point. Another researchable problem, something that we should know more about it seems to me, would be to do research with films, television, and instructional media in fostering creative thinking; I mean intuitive thinking, intuitive perception. In my remarks yesterday morning I suggested some ways in which this might be done. But it seems to me there's a whole host of research problems here that could certainly be set up and carried out. Let me say just that it seems to me that what we have to do is somehow try to develop the individuals' keen sense of environment without him being fixated upon it, and try to develop media which will take the child from this kind of clear perception of the very wide field to moving quickly to a hidden meaning relationship. I think we need research in this area.

C: On that point, there are a few findings that market researchers have and some crucial ones where we've indicated that intuition seems to be a major, if not the major single basis for purchasing.

C: I would tend to agree with a former point where you say that we do not challenge individuals. And yet, at another point, research seems to say that youngsters who are not challenged but for whom there is too much expectation cannot be creative where there are too heavy demands made upon them. Now, are these irreconcilable or different?

C: No, I think again I ought to discuss what I've stressed before, the need for much more differentiation in our approaches. For example, I think in the case of the culturally deprived child, if he's going to be brought up to levels which we want this child to have, to be given a great deal of information, a great deal of input. How much can he take? We don't know how much he can take. I suspect some can take more than others. I think this is a terribly important topic. I always refer back to individual differences which would always have to be atuned to how much you can put in. I also think that the place where we don't sufficiently challenge is in the case of the really bright and gifted child. We certainly have some tendency to keep them down.

C: Do you think in some cases that parents have expectations that are unrealistic even among these phenominally bright youngsters, that they expect too much, demand too much of them at a given developmental stage?

C: I think we may demand too much of them in terms of certain conventional successes and not demand enough from them in terms of cognitive processes and getting a richness of experience. That would be my point.

C: This is precisely what happens in the schools when you suddenly impose upon a school system a program for gifted children or creative children. Teachers without any other resources to which they can turn, simply say they are going to add more hours of assignment and more hours of homework and more hours of the same kinds of things.

C: And they do.

C: And this is precisely what happens. This they think is giving children more help, more challenge. This is what they claim to be challenge.

C: When I say challenge the child I mean stimulate the child with some problem so that he goes into it in depth. I think that if you can develop this kind of intuitive capacity in individuals, you don't need to be an expert in all fields. What you've got to do is to develop some capacity and ability to be intuitive about a field so that with a little knowledge you can come up with very good hunches as to what will work. This is what characterizes a creative architect. He isn't an engineer, but he has enough knowledge about engineering so that he can do it. He feels what kind of structures he can design freely on the back of an envelop. Then he gets an engineer to work out the details. And if he's a good architect, he isn't drawing impossible things, but things that the engineer can bring into realization. With the increasing amount of knowledg in an increasing number of fields which the contemporary man has to know in this increasingly technological society, I think we've got to develop this kind of intuitive capacity more than we ever have in the past. But how to do it is something we are not too knowledgeable about. It seems to me a terribly important research area, especially with respect to instructional media.

C: Certainly in terms of the present research known in instruction for example, most cases show that children can go much further and take much more than we believe. I think one thing in relation to your remark that's important is that in some ways the developmental nature of the youngster and the problem with which he's dealing as a maturing individual makes a difference in how he meets one's expectations, that is the outside expectations. I think that we haven't done enough research in terms of the models of identification that is the way one uses a great many models of identification, and I should think in our high school especially we need it. But perhaps earlier. This needs to be researched. I think media certainly in presenting men at work at different times in their lives, presenting autobiographies and so forth, could present kinds of models for identification.

C: Well, I would like to underscore that point about the necessity of a multiciplicity of models because our finding on highly creative individuals is that they are less apt to identify to either one parent or the other parent or not identified with either parent but tending to identify with several people in the extended family circle, that is, with uncles and aunts and grandfathers and grandmothers and others in the environment with whom they do make identification. I think a multiciplicity of models is very, very important and, of course, this is where reading books is a wonderful experience and having all these models of identifying in part with them.

C: This is one area. There's another area that I'd like to mention that's quite distinct, and I just raise it as a question because we used many words without knowing it. We have talked about the creative teacher. We assume that the creative teacher, and we haven't defined the creative teacher yet fosters creativity in children. Actually the two or three studies we have with a definition of creative teachers used, and you may guess I'm a little skeptical of the definitions, there has been no relationship between the creativity of the teacher and the creativeness in children; that is, they have not fostered creativity in children. Now understand this is with the definition used. But I think in terms of research that we need to investigate this very carefully so that we have a more accurate definition of creative teachers and so that as time goes on we really understand the relationship between whatever definition we use.

C: When we talk about a creative teacher we might be talking about a creative person or defining a creative teacher in terms of what she does in the classroom for students. We can speak about a creative teacher in another sense; namely, that the teacher has the characteristics and traits of the creative person. It seems to me that perhaps one can have a variety of ways in dealing with children. The important thing is that the teacher, the creative teacher, has the flexibility and experience to do these other things that we have identified as the characteristics of the creative individual.

C: This is what I was saying.

C: I would speak of these two kinds; that is the teacher with creative characteristics, or the teacher who performs creatively before the students or does something so that the students perform creatively. I think these are the kinds of questions you were asking.

C: Well, I'm just saying this area is an area that we need to research because we really don't like to go on and speak blindly. We do want to decide with some care what we are talking about. I have become very much interested in this because of the fact that the relationships have not appeared that were anticipated.

C: I have worked with a number of ideas in the conference and I don't think I should take time to review them all except perhaps to make one illustration and a major point. For instance, one may test the hypothesis that the basic forms in each major subject-matter area may be conceived as creative systems. Consider its basic form such as the following: in the physical sciences, the atom, the molecule, the electromagnetic system, the solar system; in the biological sciences, the central organ, the organisms, the systems of birth, growth, and evolution; in psychology, the systems of perception, learning, communication, and maturization; in sociology and anthropology, the social institution, the social role, and the evolution of society; in the arts and humanities, the systems for the production of art forms or the forms for the products thus produced. This is by the way back on the content point. Developing the capacity to be able to recognize creative forms all about us in life and exploring this possibility. This suggests one thing that I feel would be quite important as far as research is concerned. There should be the opportunity provided for conceptualization. Inquiry should be a function of design that invites need.

C: We certainly need as much knowledge about application in terms of real knowledge, research terms as we do about the basic steps. I think in my own work and in the work of a lot of other people working in creativity that we are not applying the knowledge available. That's kind of a need to be developed. This is one of the bridges left--we study creativity in our classes and labs and studios. I'm much concerned with the human element as specified in some defined interaction system with individuals in connection with creative products. I don't frankly know what the human element is at this point but I want to keep studying that one. I don't sufficiently have any hunches there to help me on my vague hope with that except through the things we've seen in classrooms. They're details and do not go together in terms of continued or sustained learning as far as I know. This is a hard model to deal with. We are beginning to get hunches and we begin to face them witha meager level of knowledge by looking at products that people turn out. I think the whole creativity field should look at itself a bit and risk a few hunches. I don't think we have any real models of dynamic creative learning.

I think that it's about time we take a risk. I'm not sure we get these by describing great men, or all these things that are very important on a real base for being creative. I mean in terms of hard-nose operations that we can put a little confidence in. I don't know when that'll come. I'm not sure that we are going to blast the criteria and predictor and environment problems simultaneously. If we have one aspect change, the other changes too. In terms that we can put our fingers on we were talking about the need for a multiplicity of models with young people. Yet, we need exemplars of definite identification. These things can be looked at much more vigorously than we have. I don't know how to get at them. We haven't nearly finished the job of describing where we think creativity does exist in existing systems, or descriptive tasks as describing creative architects and their work. These kinds of things might pry something loose from its place in the environment that makes creative people. It might be worth forgetting the school and thinking of alternatives to classrooms. Children have strong identity models where they're associated with and not just external figures. People are highly committed to something, but how you get this choice and also get depth is something that I can't struggle with. I think we can operationally begin to ask questions at any rate. The other thing that I should say about this whole business is that we do not have too many answers at this point. I can think of better questions than answers about creative learning.

C: I like this last point that maybe we should free ourselves from the structure that now exists as a school. Maybe we can get completely away from it, and this opens up some different areas of research I think.

C: I've been reflecting again on this whole matter of teaching models in relation to new media. It's always disturbed me that a child gets sort of jailed with one teacher until the seventh or eighth grade, and there's no escape from this. And I literally mean jailed for both the teacher and the youngster because I don't think either of them has a chance to associate with anyone else other than the children in the room. The teacher doesn't get a chance to see anybody else teach, and the child doesn't get a chance to see anybody else teach except the teacher. Now what in the world can media do in order to provide this input into this classroom that is not there now? On this matter of sex differences, what would happen if, for example, through television we could bring the figure of a man teacher for part of the day so that there would be both a man and a woman in the classroom? I am sure we'll never be able to recruit enough men as first grade teachers to make much of an impact if they have to be in the classroom with the children. You sure could however, recruit some by TV. It wouldn't take very many with television.

C: Many children don't have any men available at all in the first grade because we have so many children from broken homes, there is no father figure at all around, and then they go to school and still no father figure except the janitor or the custodian. Maybe we could investigate this matter of feedback in terms of additional people in the classroom that could be brought in by television in terms of what impact they would have upon children. Then I'd also like to see what impact it has upon teachers. What happens if additional teachers are brought into the classroom by television and selected not with the idea that they're master teachers but teachers represented and selected on a different basis? If you take two teachers in which classes have achieved equally at the end of the year, so that there's no difference between these teacher's in what their youngsters have achieved on their achievement tests. Then if you correlate the intelligence of the youngsters by an intelligence test with their achievement scores and get a large enough pool of teachers you'll find some teachers where there's a very high correlation between intelligence scores of the youngsters and the progress these youngsters have made during the year. You will find other teachers where it's low. Yet the mean achievement of the two classes is the same. So that each has taught, as far as this group is concerned, equally but the impact of teaching upon these youngsters in the two classes is different. That is, we've got two styles of teaching. Now the teacher that intrigues me is the one who can lead a class along and get maximum achievement at the end of the year even where there's not a very high correlation between measured intelligence and achievement. It seems to me that this teacher is getting to youngsters more than the other teacher. Maybe she's defaulting on the bright ones, I don't know that yet. But anyway it seems to me that those teachers who can teach well should be televised so other teachers can see them irrespective of whether they're creative teachers or what because of what they are making of their students. It would be worth while to pick up cues consistent with ways these teachers think teaching should be done. What you're doing is televising different teaching models for the classroom without paying too much attention whether one is creative teaching and the other is not creative teaching.

C: Maybe you want the other two models, too. The one that relates to the high ability youngster, and the one that relates to low ability.

C: That's right.

C: Now there's another aspect that I think must be read into the record here in terms of research and that is we should do more work on a longitudinal basis. If we are going to study students learning to learn, or perpetual students or growing students, or whatever term you'd like to use to describe students then in some way you have to test whether this kind of environment, this kind of teacher behavior, has the longer range effect. I would imagine that the longer-range effect is quite different for the teacher who teaches for all children so that all children gain than for the teacher who teaches for certain types of children. I would think that this might be a tenable hypothesis. I would also like to speak a little bit more for a wider spread discrimination of tenable hypotheses because I read time and time again reports that there were no differences found and results were not as predicted but the hypothesis in the beginning was not a tenable hypothesis. If we had put what we know down we would have known enough to have predicted that the hypothesis was not a tenable one. We make a point of sweet designs, conventional designs, regular designs; but apparently if you do the design right.it never matters what the hypotheses say. This I find disturbing and an unhappy state of affairs particularly in funded studies. Some of the doctors' theses I can control, but funded studies I can't.

C: This is what I was asking for in the very beginning this afternoon. I think we have to know what some of these tenable hypotheses or testable hypotheses are and coming from this kind of group we should have some clues as to which ones are tenable and which ones are not tenable.

C: Well, I think that we can too. I think that this really is a very important thing. The material we have now from longitudinal studies and material we have on creativity and on individual differences including sex differences will be able to serve this function. I have a study which is about ready to go with 80 first-grade children. The study was done in the summer on vocabulary. One of the things we did contrary to most studies on vocabulary was to use words from a sampling of life; that is, we had words like insurance policy, insurance, range, and installment and words taken from life following some of Russel's identification in areas of life. Using those kinds of words we got the boys statistically superior to the girls in concepts and even more superior to them in the abstractness of their concept. In other words, boys have been out around. Girls might name the insurance in terms of the piece of paper you use to get the check for your car when you hit somebody but that's all. The boys could define terms more abstractly.

C: Why are boys still behind girls at the end of the first grade in their reading?

C: From our selection of words, I think only two of them appeared in readers before the latter part of the third grade. Can you understand, our selection had nothing to do with reading. It had to do with life and with the child's life experience.

C: Maybe we ought to have different texts with boys than with girls in the very first grade.

C: I think we should.

C: That's right. Maybe we just don't have the right materials.

C: But we do have some investigation in areas that tell us such things.

C: Well, aren't some first grade classes writing their own texts?

C: Yes, and it has been shown that the girls are nicely verbal for the teacher; the boys are nicely verbal for other boys.

C: Well, if they had a man teacher, I'd feel better.

C: I am going to be bold to assume that we shouldn't scrape all instructional materials and pose three hypotheses: one, that the teacher is fairly rigid and set. Secondly, there are some nice visual aids or books and materials customarily used by the teacher because she likes the feel of them or because she has used them before and she is comfortable with them or because they're available or because they're in the curriculum guides or for some reason. And third, that perhaps we could conduct some type of research on how to use and manipulate these devices to get creative responses. Now what I'm proposing is this, let's go to a city or county audio visual library and identify the top most used films for example. Let's take these ten films that we have identified as mostly used by the teacher and then conduct a short teacher in-service training program using the Guilford model on how to use these training aids, these films, in getting at cognition, getting at divergency, getting at convergency, getting at evaluation, and so forth. So then teachers can be trained how to put in cues, how to put in instructions for originality, how to ask questions. Show them how in the films you might say, "Well, this is an implication, this is a transformation, this is generalization." Then take these into the classrooms, measure some kids pre and post, use the films, and see if there is any change.

C: I'm going to hitch-hike on this because this to me sounds like a wonderful idea, but I'd like to suggest one other thing. You could show them how to question, show them how to do this or that and let them do it instead. I mean, show them the concept of the question and let them develop it within the films. Use varied techniques on themselves and then watch them and see how they do it. They may be doing a pretty good job already. Well, I think what I meant by show them is to give them some feeling for the Guilford model and what we mean by the creative process of human intellect. But then I mean let them translate it into their own methods and I think you could draw it out of them if they aren't doing it already.

C: I think it is rather important to get a feel of who does what when; and what effect we have on the learner who thinks as a creator. These kinds of studies I think are crucial by getting right at the heart of the teacher and the instructional media role of teaching. We need more emphasis on what's occurring inside the student with content. We must get into this discussion about providing instructions to go along with audio visual or instructional media and to what degree these are available and what variations can be given to them. We need to give teachers all kinds of suggestions until they can find one among them or even think up one of their own that works. Now I think there should be some research on that. We need to study this great variety to see what difference this makes. Then not too different from this is taking one or two techniques and breaking them up. Maybe we should go after some material as is and see what's the best we could select by just leaving it as is and plug into the classroom. Then study some techniques or materials that have been modified by some of our best educational engineers or some that are modified by the teachers themselves to test their effects. We might get some in education models. Then the next step is instead of taking what's available, start back, clear back from scratch, up stream and build stuff from scratch deliberately designed for this new research and see to what degree we are sharpening ourselves up by building something professional for our purpose rather than taking something that already exists and putting in a few modifications. We ought to learn quite a bit from that.

Chapter 13

Overview with Models and Summary Lists of Tenable Ideas and Research Areas

Frank E. Williams
University of Utah

The rationale behind the Conference on Creativity and Instructional Media was that educators and media people now wanted to explore ways to improve creativity in the classroom through the use of instructional media. Yet, little is known through research about the effects of various media or how they can best be produced or used for evoking creative behaviors.

The conference objective was how to get leading creativity researchers and instructional media experts together to discuss how new media can be designed or how teachers can use existing media for developing more fully the human resources of creativity in classroom situations.

The techniques of teaching by audiovisual devices are not new. Means of communicating information through audio and/or visual media have been part of an educational and technological revolution during the past quarter of a century. Audiovisual devices present a wide range of methods for storing information and provide a reliable means for retrieving it quickly and efficiently. Such devices involve two primary storage forms which include the electronic storage of audio information. and the storage of images on film or other plastics. Retrieval of information which has been stored on tape and plastics appeals to the combined visual and aural senses of the learner and can be used as adjuncts to the important role of the teacher in school classrooms. Any reasonable recognition of differences in student abilities and learning skills would admit to the necessity of presenting students with as wide a range of avenues and sensory inputs as possible when acquiring information which could lead to the fullest development of their talents while they are growing in knowledge. It may take combinations of books, tapes, films, machines, and the teacher to meet this challenge.

It is now known through measurement research on high level abilities and talents as well as laboratory research on learning and concept formation that a rather large number of intellectual processes of the human mind can be identified and developed. Taylor (Chapter 1) writes that students must have the experience of using and developing a great number of these learning and thinking processes during times when they are simultaneously acquiring a variety of information through subject matter content in a total educational program. Without depreciating the important role that the teacher must continue to play in the total educational program, by the very nature of the growth in knowledge during the past decade along with the recognition that many intellectual and non-intellectual dimensions of the mind need to be developed, we can not neglect the manifold storage and retrieval methods that are available through media devices. The teacher's task in the learning-thinking process must include acquiring information through memorization by traditional classroom methods along with developing the other intellectual processes of critical thinking, productive thinking, creative thinking, planning, decision-making, and communicating. Other non-intellectual categories such as intuition, sensitivity, emotion and feeling, insight, involvement and witholding judgment are likewise important when experiencing, practicing, and developing the mind's full range of potentialities. The unique and important role for teachers becomes that of how to bring this all about by the use of their own knowledge and techniques as well as the potential repertoire of perceptual inputs that various media can provide.

Assuming one of the tasks of education is the development of those intellectual and non-intellectual processes leading to creation it seems feasible that one should consider the basic research that has been conducted on the nature and nurture of creativity. The work done in this field over the past decade has shed considerable light upon the traits and characteristics of the creative person as well as the conditions under which creative behaviors might be developed. Therefore, the purpose of this chapter is to define and discuss the terms "media" and "creativity." Two conceptual models as aids in using or designing audio-visual media for evoking creative behaviors are developed. Then a list of the common most recurring thoughts or ideas given by the participants throughout the conference from a gleaning of the complete conference transcriptions is presented. This list is a synthesis of the mass of material presented at the conference, as attested by the size of this document, which will enable the reader to quickly grasp the salient ideas generated during the conference. In conclusion is a list of research areas and questions which were opened up throughout the conference as leads and needs for future study.

Media as Information Transmitting Devices

By definition, media includes all the aids for transmitting information and learning via the senses; such as printed materials including books and programmed devices of instruction; the graphic arts including transparent slides, pictures, charts, film strips, and video tapes; audio materials including tapes, recorders, radio, and language laboratory equipment; and combination audio-visual materials including the sound motion picture and television. Media devices are visual and/or audio stimuli designed as external inputs to a receiver and can be classified in the following manner:

Visual Stimuli inputs

Pictorial

Print

Audio Stimuli inputs

Verbal

Non-verbal

Information is defined from the psychological point of view as bits or items which the organism discriminates and serve as communicative functions.

Audio-visual media devices, as a means for transmitting information, have generally taken opposite trends for their design and use in school situations. One apparent trend has been for use in mass instructional situations. Such devices include educational television, radio broadcast, or video tape; mass motion picture or film strip series covering a specific subject; fragment film clips demonstrating a single principle, skill, or function; and Vugraph or Overhead transparencies. Another trend has been in developing individual instructional devices for reading, listening, reviewing, and programmed learning. These include textbooks, workbooks, tape recorders, teaching machines as well as language laboratory equipment. The latter category now includes libraries of electronic aids for individual instruction or student review of information previously presented in mass learning situations. Both of these trends in the development of media materials have specific implications pertinent to the nurturing of creativity in the student.

It must be pointed out that all of these devices have been programmed to transmit information. Most of the studies on their effectiveness relate to the absorption and recall of presented factual information through the use of audiovisual stimuli in contrast to situations not utilizing such stimuli. Methods of evaluating audio-visual learning make an implicit assumption that such a successful teaching device is one in which students who have participated are expected to differ from what they were before this experience as revealed by an appropriate instrument measuring the amount of factual information they have acquired. An audio-visual device is considered an optimum aid to teaching the more nearly that a one-to-one ratio is approached between the kind of amount of information presented to the student by the device and that amount which he can recall on a test. Audio and/or visual media devices can be of tremendous help in supplying a vast amount of information to the student, but unless the device is designed or used to allow something to be done by the student with this information other than to merely receive it and recall it when conditions demand, it's potential as far as developing creative behavior is seriously limited. It may be one thing to deal with ways to effectively transmit items of information for recall; it may still be another thing to impart and deal with an array of stimulus inputs which are necessary for creative thought and creative action.

Creativity Related to Information Transmission

There are two kinds of talent consisting of different mental abilities which either involve acquiring information produced by and transmitted to some one else; or utilizing someone else's transmitted information to generate and produce one's own new ideas, pose different problems, or produce new knowledge. It is the development of these latter abilities which enter into creativity. An abundance of rich sensory and perceptual input is not enough unless something is done with it beyond learning to recall. Creativity starts with sensory and perceptual input, and the person desiring to create within any subject needs an abundance of input information about the subject. Conditions which facilitate creativity first depend on a storehouse of information within the person who is attempting to be creative. The amount of stored information of the potentially creative person seems to set the limit on such behavior. But sheer accumulation of information is not enough. It is how the person goes beyond learning to recall information by what he does with information that makes him creative. MacKinnon makes the point (Chapter 7) that the more items of information the person has the more likely it is, on purely statistical grounds, that he will be creative.

The process of creating is in large measure associating or putting together in new and original combinations the elements of information which one has previously acquired. Thus, we must consider an originality or inventive factor as well as several kinds of flexibility factors that play a role in creative thought and action. Likewise, the more combinations one can form, the more likely it will be that some of them will be creative. Along with originality and flexibility are various fluency factors such as flow of ideas, flow of associations, and flow of expressions which also are important. The combining of items of information and the forming of new associations are outcomes of breadth and depth of knowledge, and the ability for their production depends on the establishment of associations between items of received information. Media devices can so quickly and so effectively increase the students items of information which in turn can contribute significantly to the nurturing of creative potential provided they are designed or used in the right way for this purpose.

Increasing the richness of stimulus input into a students repertoire of knowledge and allowing him opportunities to work with such inputs seem to be the crux for teaching creativity through the means of the audio-visual medium. So it is that creativity may be defined as relating previously unrelated things, combining items of information is new forms, fusing of past knowledge with the present flow of new information to produce original insights and unusual responses, or the conversion of accustomed knowledge to the unaccustomed idea or act. The mere saturation of an individual with input information may have to be integrated with instructions or cued directions to be creative, opportunities for creating, or training in the utilization of mental processes other than assimilation, storage and recall. The processes of exploring new associations from an array of input information are necessary prerequisites to making discoveries and must be granted students in order to develop abilities for autonomous and creative thinking. Media devices as rich sensory inputs may only set the stage for the student to go on from where the device leaves off providing it is arranged or manipulated for the student toward this purpose.

The problem becomes that of how this can be done either by the media device itself or by the teacher using the device or both. An interaction between the teacher and the device is necessary when attempts are made to structure or reorganize the presentation of input information to the student so as to produce student outputs to include all of the fluencies, flexibilities, elaborations, and original interpretations of knowledge that comprise the creative process. The teacher can then become a catalyzer in producing a need to create. The media is used as a rich source of input which may set the stage for the creative act to follow.

A Model for Using or Designing Audiovisual Media to Develop Creative Behaviors

A proposed three-dimensional model for viewing the arrangement or manipulation of information transmitted via audio and/or visual stimuli for the purpose of evoking creative behaviors is presented in Figure 1. Each dimension of the model shall be discussed separately as follows.

The first dimension takes into account the complexity of research on creativity which has been focused primarily upon six variables. These are: (1) the product created; (2) the process of creating, (3) the personality of the creator; (4) the tasks chosen for attacking or assessing creativity; (5) the environment or favorable climate in which creation occurs; and (6) the training techniques for developing or releasing all of the intellectual and non-intellectual abilities that manifest creativity. These six variables may give clues from creativity research studies by which information can be arranged as sensory inputs via media devices for developing creative behaviors. Thus, audiovisual input information may be devoted primarily to appraisal of the products that require some criterion for measuring the degree of creativity shown by an individual; exploration of the thinking and problem solving processes involved; examination of the kinds of tasks or problems selected and undertaken for creative attack or measurement; investigation of the psychological and physiological traits or characteristics of creative persons; study of the social climate and environmental variables that both aid or hinder creativity; and the recognition of certain operational techniques which have shown most promise in fostering creativity in training situations. It should be pointed out that these are not independent variables and that interaction between the six variables will most likely take place.

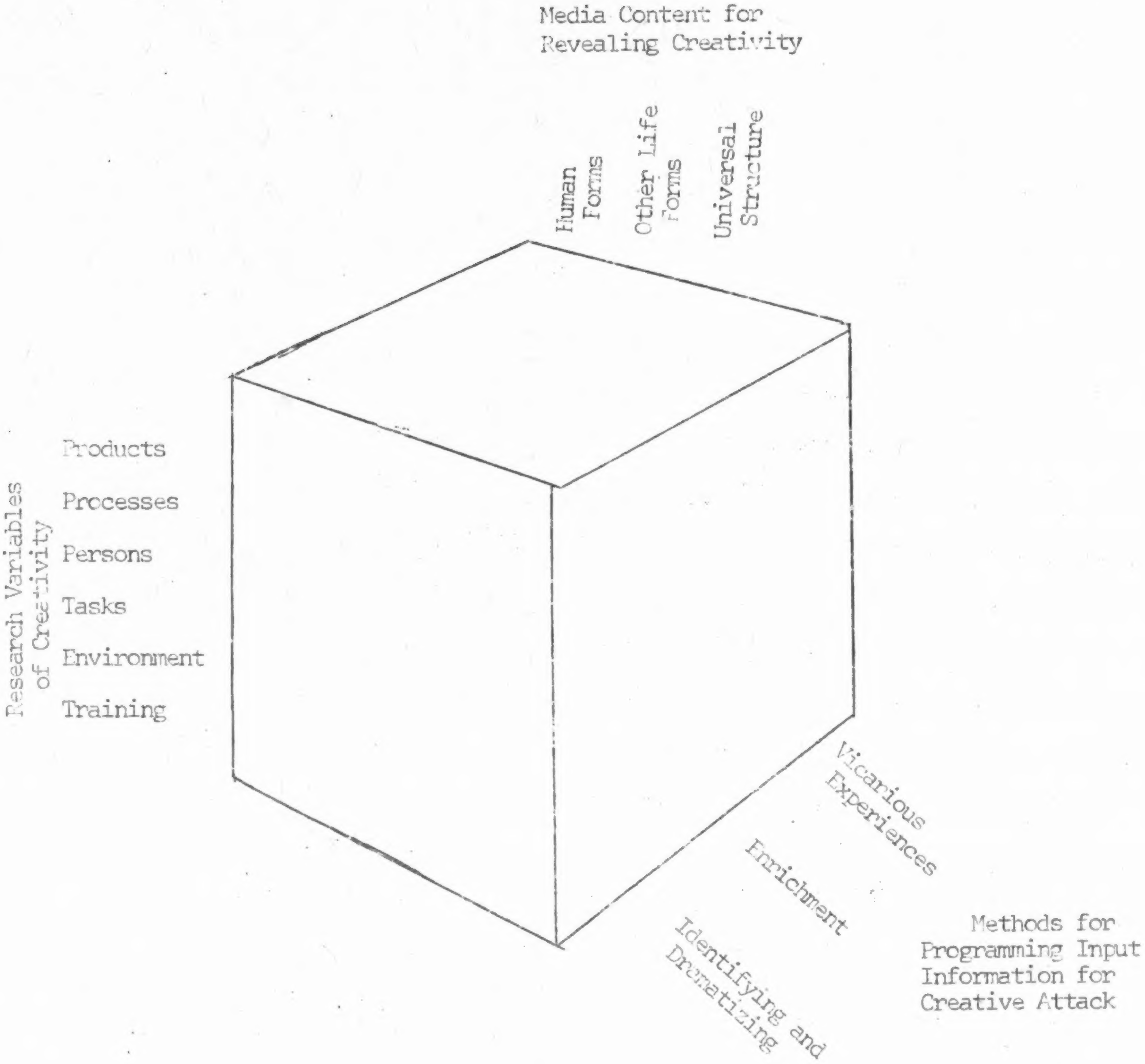

Media Content for Revealing Creativity
Human Forms
Other Life Forms
Universal Structure
Research Variables of Creativity
Products
Processes
Persons
Tasks
Environment
Training
Vicarious Experiences
Enrichment
Identifying and Dramatizing
Methods for Programming Input Information for Creative Attack

Figure 1. Model for Using or Designing Audiovisual Media to Develop Creative Behaviors

The existence of such interactions should be capitalized upon for the design of an audiovisual device. For example a film may want to portray the particular traits of a highly creative individual as related to the type of task upon which the individual works, the climate under which he produces, and the kind of thinking which he performs. All such interactions do exist and are important.

A second dimension involves the content which media need to reveal when designed or used for developing creative abilities. This dimension deals with what needs to be presented. Mooney (Chapter II) has discussed the creative act in three forms which become relevant for designing media content.

The first form of content is that of revealing human forms of man creating in the way his body works; his mind functions, or how his society develops.. This might involve content on the lives of highly creative people or the output of highly creative societies or groups of people in the processes of creation.

A second type of content for designing media devices is that of revealing other life forms such as plants and animals. This could reveal the birth and growth of species or events relating to creation in nature.

A third form of content deals with how the universe works. Here media could be designed around laboratory experiments, models, charts, or schematics revealing the physical or chemical operations of universal phenomena. A film for example might depict some physical principle in order to help students understand the underlying structure of a phenomenon. This form of content could be used to portray the universal structure of knowledge. Thus, the content of instructional media could be designed upon the way man, society, other living forms and universal systems work in the processes of creation.

A third dimension of the model has to do with three methods for presenting input information as an aid in the creative teaching process. This dimension deals with how to program or use sensory inputs. Media can be designed to present material to the student that would otherwise not be available to him in his ordinary classroom experience.

One method may be through presenting rich sensory inputs by which the student is given vicarious knowledge and experience consisting of a multitude of events supplemental to the curriculum.

Another method may be inputs designed and used merely for enrichment. These could be presented as extra curricular materials to embellish the life experience of the student. The greatest task here may be to program media for those not mentally or socially gifted; to deal with enrichment for the mentally or culturally deprived children who have to depend upon a rich source of materials from outside their life experience which might lead them to create.

A third method has to do with presenting materials as dramatizing events with which the student can closely identify in the act of creation. Examples of such materials might be the presentation of a historical event that is true in the spirit of creation, the nature film that dramatizes the struggle of a species in its habitat, the exemplification of an experiment or invention showing the dramatics of innovation, or exposure to greatness in many walks of life by documentaries of eminent people. Such identification and dramatizing devices might sketch out history of what man has done to create, or people in the processes of creation. For example, a film pictorial presentation of Chaucers' Canterbury Tales may spark a student's interest and lead him to a genuine exploration of English literature that the printed form of the book alone might not have stimulated. The student of history may be able to catch the spirit of the moment by hearing through magnetic tape the verbal creations of Winston Churchill or Franklin Roosevelt that neither teacher nor book can present.

In summary, there may exist instructional media devices which present materials to aid the teacher in extending the students range of experience within the curriculum, in enriching areas which might never be opened up without such inputs, and in dramatizing the significance of events whereby the student can identify more closely with such events through their true realism. It seems conceivable that instructional media for developing classroom creativity can be used or designed around the three dimensions of currently researched variables of creativity through content composed of creative forms by several methods of presentation. How one teaches creativity with the aid of such devices depends upon the skill and wisdom that both goes into the design of the device as well as the teacher's wise use of that device. Design and use become two programmed directions which will be further considered.

Conceptual Model Based Upon An Information Transmission System for the Design or Use of Audiovisual Media to Develop Creativity

As a result of a study of information theory related to the audiovisual transmission of sensory inputs an attempt has been made to develop a conceptual model concerning the design of new media or the teachers use of existing media for evoking creativity. The block diagram of the fundamental elements involved in developing creative outputs by visual and/or oral inputs is shown in Figure 2. Although admittedly much more complex than transmitting a simple bit of information, the conceptual model could, because of its very nature, be considered synonymous to an information transmission system.

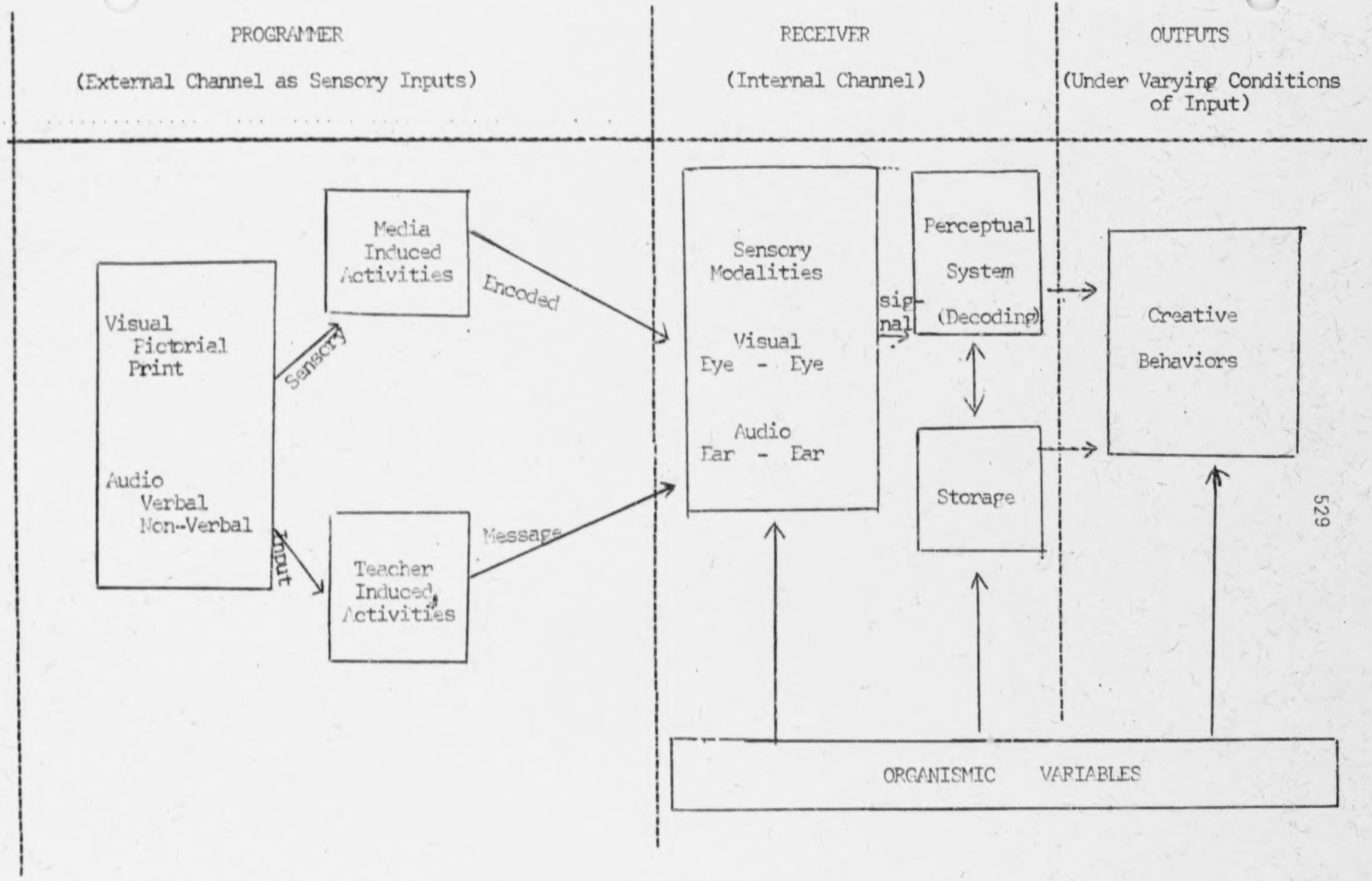

PROGRAMMER
(External Channel as Sensory Inputs)
RECEIVER
(Internal Channel)
OUTPUTS
(Under Varying Conditions of Input)
Visual
Pictorial
Print
Audio
Verbal
Non-Verbal
Sensory
Input
Media Induced Activities
Teacher Induced Activities
Encoded
Message
Sensory Modalities
Visual
Eye - Eye
Audio
Ear - Ear
signal
Perceptual System (Decoding)
Storage
Creative Behaviors
ORGANISMIC VARIABLES

Fig. 2 Information Transmission System for Evoking Creativity Through the Design or Use of Audiovisual Media

It is a linear block model beginning on the left with external sensory inputs of visual and/or audio stimuli using the classification system of the Society of Motion Picture and Television Engineers as:

Visual Stimuli Inputs
Pictorial
Print
Audio Stimuli Inputs
Verbal
Non-Verbal

The programmer section consists of these inputs as either a single input presentation in the case of an oral message transmitted by an audio tape or multi-inputs presented simultaneously such as a sound-motion picture. At this time it should be pointed out that the programmer section is an external channel which means the transmitting medium is exterior to the body. By an internal channel, such as the receiver section next on the right, it is meant that the transmitting organs are within the body. By definition, any medium that will function to transmit energy from one point to another will serve as a channel. In the case of external channels such as sight or sounds the most common medium is air. The different sensory modalities of eye or ear and their nerves are internal channels.

Transmitted messages are selected from the programmer's alphabet defined as any discrete sign-set such as; letters, words, pictorial, representation, music or sounds as discrete concepts. The same alphabet must exist at both the programmer and receiver sections of the system. If the programmer were to use a different alphabet from that of the receiver little or no information would be transmitted for each would supposedly be communicating in different languages.

The programmer scans its alphabet and from certain discrete signs constructs a chain of signs as either single inputs; for example, words in print, or combinations of inputs presented simultaneously; such as pictures accompanied by a narration to form a message.

The selection of words and/or pictures to form the message is the process of encoded at the programmer end and decoding at the receiver end. The model is shown to branch into either of two directions at the time of the encoding process. One programming direction involves producer design characteristics, and that block is labeled "Media Induced Activities." The other direction consists of ways in which a teacher elicits her own encoded message by audio and/or visual inputs and that block is labeled "Teacher Induced Activities." It should be pointed out that there is a vertical arrow indicating a downward direction between these two blocks which takes care of the situation in which a media encoded message by the producer is modified for use by additional teacher induced activities. An upward direction is impossible since the teacher has no control over the encoded message that is designed by the producer.

Media induced activities for creative outputs consist of design characteristics within the selected message encoded by the producer. Hence, it is important that if producers intend to develop media devices requiring creative outputs they should indeed arrange or manipulate the encoded message in accordance with what is known about creativity and how it can be developed. Such a message is selected *a priori* and, in terms of the information theoriest, is composed of a set of alternatives with which the programmer is concerned, known as his alphabet. In order to get the information transmitted with the desired outputs, the alphabet must be the same at both the programmer and receiver ends of the system. Already one of the greatest difficulties in designing audiovisual materials is obvious. It is imperative that the programmer have a specific knowledge of the audience for which the audiovisual device is intended in order to determine if his message is comprised from the same alphabet as that of the receiver.

For purposes of illustration let us follow an information transmission through both branched directions of induced activities beginning at the sensory input end.

Our first source of inputs will be from an educational film producer who has designed a sound-motion picture for developing creative behavior. His alphabet will be selected for the particular grade level audience he wishes to communicate with and will be words, concepts and pictorial perceptions. For simplicity, let us assume that the receiver, a student, has an understanding of the words and pictures used by the producer; and that the meaning of both the words of the narration, the pictures of the video portion, and their underlying concepts is common to the producer and the student. Thus, we have now satisfied the condition that the programmer and the receiver have the same alphabet from which to select signs.

The producer wishes to have the student create an original solution to a problem. Thus, he selects the factor of originality out of the paradigm of divergent thinking as one of the desired outputs for creative behavior. He chooses problem solving as one way for developing original thinking and designs his device accordingly.

Then suppose he has the knowledge from research evidence concerning a very simple but effective training technique for eliciting creative responses by posing questions with instructions that original answers are desired. The producer designs an open-ended film known to be useful for developing the creative potential of viewers. Video and audio inputs are arranged to pose a problem with events leading up to a solution but not showing the solution. Furthermore, by the producer knowing that the technique of using questions with instructions to be original produces creative outputs, a media induced activity could very well be that of inserting print questions at the crucial point in the film where the audience is asked what they would do to solve the problem and instructed to generate their own original solutions. Instructions should likewise be given to the teacher to turn the machine off at this point in order to allow students to create their own solution before being shown the solution as given in the film. This is an example of a media induced activity for developing creativity which could be used directly by any teacher without modification.

Our second source of inputs might be teacher induced activities which imply how a classroom teacher uses a multitude of stimuli, such as, books, charts, video tapes, film strips, or sound-motion pictures out of which students may develop their own creations. For simplicity let us cite the same technique discussed above for using a sound-motion picture to aid in developing an original solution to a problem. Let us assume that the teacher also has the knowledge that questions and instructions to be original are effective training techniques for developing creativity, and she is able to select a film that poses a real problem. Then by simply stopping the film at the crucial place she could verbally ask questions and give her own instructions for students to be original in thinking up their own solution before turning the film back on to show the solution as given. This is an example of a simple teacher induced activity as a modification of an existing audiovisual device but used for creative attack.

It is important, however, to note that in both types of activities a knowledge of the creative process and how it can be developed by both the producer and the teacher is imperative. Hence, an understanding of the first model discussed in this paper is important.

The media induced and/or teacher induced message is encoded, signifying a transformation of the message to be transmitted into light rays (visual) and sound waves (audio). The encoded message is sent via a medium to a receiver. In the usual sound film the medium is air, and is known as an external channel meaning the transmitting medium is exterior to the receiver. It is then taken in by the internal sensory modalities of the receiver.

While the message is being transmitted by the organs and nerves under the skin, the possibility exists that it becomes filtered or mixed with noise. Or the possibility also exists that the message can become mixed with noise in the external channel. This is probably more often the case than in the internal channel. Irrelevant information sent on the source channel would consist of sounds and images not programmed into the stimulus array but arising in the environment. Such disturbances which do not represent any part of the encoded message are usually considered noise and, having no bearing on the message, leads to an irreversible loss of information being transmitted. This loss in the information rate from the source of the message is called entropy. Communications engineers have considered the possibility of a noiseless communication, or one in which no loss occurs. If a noiseless system were possible then redundancy would serve other purposes than compensating for information loss due to noise. If this is not so, then redundancy in the transmitted message may be necessary in order to counteract for the results of noise with its consequent information loss. Redundancy, or an excess of various stimuli, between simultaneously presented inputs in the sound motion picture is not uncommon. For example, an explanation is given in the audio narration which refers to the visual picture. One is supposed to strengthen the other. It is not known, however, whether redundant cues should be presented simultaneously or whether they should be sequentially spaced so that the receiver need only to attend one at a time in order to decrease a loss resulting from interference.

As the message is carried further into the receiver's perceptual system other transformations of the visual and aural waves occur in the brain which is known as decoding. In the case of a human system it is not possible to measure the reception of the message by its intended meaning other than through the measurement of the subject's behavior or output. Here again are many problems with regard to measuring outputs which are dependent upon the organism's character; hence, the underlying block of organismic variables. The decoding of transmitted information and a valid measurement by different types of actions, or changes in behavior, is indeed one area of extreme complexity.

Evidence indicates that the type and amount of decoding with its subsequent output or change in behavior is a function of how the inputs were arranged by the type of message transmitted or how the device was used. It may be the way it is used which determines its value. A certain kind of message and arrangement of inputs may produce one type of output, but not necessarily other outputs. In other words, a message designed to produce originality may just only do that, but may not also be expected to produce fluency, flexibility, or elaborativeness. Likewise, if a motor skill performance as an output is desired, it is likely that another type of message under differing arrangements of inputs is necessary other than the one used for making original associations. An implication may be that a message with certain manipulations of inputs may only produce one kind of output, and no others. A film designed to produce creative behavior may not also be expected to produce recall or develop a motor skill. This is an area in which little research has been conducted.

Tenable Ideas for Use by Media Producers or Teachers

Now that a general model of information theory and two of its applications have been discussed, it is in order to list some tenable ideas and research areas brought out during the conference. These have been gleaned at random from the conference transcriptions having no order in their importance and credit should be given to all conferees for their mention. It is hoped they will serve as ideas upon which instructional media producers as well as teachers will be able to innovate. Since instructional media are innovations, this section is intended to open up questions of what and where innovations are needed.

Ideas

1. Program media by taking into account the intellectual level of the intended audience. Develop media for those not performing well in verbal abilities; i.e., those not of highest measured I.Q.

2. Design or use media for stressing a multiplicity of approaches to solve problems.

3. Design media taking into account individual differences; i.e., sex, intelligence, grade level, reading comprehension, creativeness, amount and type of deprivation.

4. Use media to develop independence of thought activities.

5. Design media for teacher instruction and teacher preparation showing various means for rewarding and encouraging autonomy in the classroom.

6. Extensive use of media for presenting modes of search and inquiry.

7. Design media depicting creative individuals making a work of art out of their own lives.

8. Design or use media which shift from adjustment to development; i.e., show failures, constructive discontent, anxieties and conflicts overcome, improvements made, things that bother people and how these can be changed.

9. Media producers and teachers must understand the various kinds or types of creativity in order to know which kind they are developing by what medium. Different ways of using or designing media may be necessary for developing various kinds of creative behaviors.

10. Design media around the specific purpose of utilizing principles of creative thinking and problem solving; i.e., analogies, similies, paradoxes, metaphores, attribute listing, deferring judgment, check listing, etc.

11. Design media around the two main value systems of creative people which are aesthetic values including elegance of product as well as idea solution and theoretical values of functionality and practicality.

12. Use media for the sole purpose of leading students to self-generated activities, thinking independent, goal-setting, and setting their own problems.

13. Design media around the mystery of things; i.e., birth, the universe, hypnotism, intuition, insight, etc.

14. Develop media for presenting biographies of creatively eminent people.

15. Develop media devices dealing with generalized problem-solving skills; i.e., preparation, incubation, illumination, ideation, verification, etc.

16. Design different kinds of media devices to be used for teacher instruction than for student instruction.

17. Develop teacher in-service training films around the themes of creative teaching (what it is) versus teaching for creativity (how to do it).

18. Use the technique of delayed feedback instead of immediate feedback in media devices for evoking creative behaviors.

19. Produce media depicting the home environment of creative children or child rearing practices for creativity based upon research evidence to be used for teacher-parent groups.

20. Locate a group of very creative teachers and find out what and how they teach. Produce an instructional media device based upon their methods and procedures for teacher in-service training programs.

21. Produce two companion media devices (films); one to be used for showing the classroom teacher how to produce a need to create followed by a second one for students containing rich sensory inputs for releasing their creative abilities. Both should be used together in a school.

22. Design media as guided - planned experiences around scientific discoveries.

23. Develop new teaching materials or convert old materials to the divergent thinking paradigm.

24. Develop media for elementary school children around the techniques and methodology of research.

25. Design media which purposely present knowledge having incomplete gaps; i.e., knowns as well as unknowns of a field.

26. Produce media for presenting rigidities or functional fixation in the design of things with questions posed of why they haven't been changed as well as how they could be changed.

27. Design or use media for teaching children how to live with change; to change the environment rather than adjust to the environment.

28. Produce media based upon the present contemporary goals of society; learning how to learn, learning how to change, learning how to create, learning how to adapt rather than adjust.

29. Design media around a series of events depicting endurance, persistance and perseveration with resulting incubation and verification--the insight!

30. Design media showing man in the process of creation and how he reaches into the unknowns and the unconscious.

31. Sketch out the history of what man has done to create through the use and design of various media.

32. Design media around paradoxes of a field or subject.

33. Design media showing people in the process of toying with new ideas, how to care for and nurture infant ideas.

34. Produce media (training film) for teachers which would help them to see what their new role is in teaching for creativity. Produce a similar film for student teachers to help them to see their role as creative teachers.

35. Design media for teachers viewing based upon research evidence depicting when and how teachers can reinforce creative behaviors in classroom situations. Design media for the same use but showing teachers failure to reinforce creative behavior with their resulting consequences.

36. Produce media (film strips) to show samples of various tests for creativity.

37. Produce media (film strips) for experimenting with instructions to think creatively and drill procedures for such behavior.

38. Design media to provide more feed-back for self-evaluation at different stages of the creative process (see Guilford Model for Human Problem Solving).

39. Design media solely for the purpose of transmitting rich sensory inputs through animation, color, sounds, noise, and all combinations to be used for releasing creativity.

40. Design media for showing how items of knowledge can be combined and new associations formed to make the real creative idea. Use the theme "Nothing new under the sun" and show the importance of associating and combining items of past knowledge to create the new.

41. Design media to only pose problems or ask questions with rich inputs to clarify a problem situation and adequately define it. Go no further but leave it open for viewers to solve.

42. Design a series of short companion films each to portray the three kinds of creativity. One could show sequences dealing with groups of people and interaction processes dealing with social creativity. Another could be an autobiographical sketch of a person dealing with his own relationship to himself bringing out personal creativity. The third could be the development of a highly original idea which was translated into the development of a novel product demonstrating productive creativity.

43. Show the conclusion of a film and have students guess what the beginning was. Choose a film that poses a problem and solves it but only show the solution end and have students define the problem--or vice versa.

44. Design a trunk film for classroom use which defines a problem with very rich and embellished inputs about the problem situation. Have this accompanied by a number of shorter satellite films or film strips each showing a variety of solutions to the problem. The latter could be used for individual viewing and verification only after each student has had the opportunity to create his own solution.

45. Produce films or film strips around lèisure time activities of inventors or patent holders.

46. Produce a teacher training film on how classroom teachers can use media to set problems for different students and in encouraging students to set problems for themselves as suggested by the material seen in the media device.

47. Produce media for portraying the early life anxieties, conflicts, and uncertainties of highly creative people with an emphasis upon how such problems were overcome or contributed to their creating. Could be for counseling and guidance and mental health uses.

48. Design media that will actually engage students to do and perform those things which they will be doing in other creative thinking and problem solving situations; those requiring active drill and practice in the creative process rather than passive listening and watching.

49. Reproduce the symbolic and imaginative short film "The Hunter and the Forest" in color (Brittanica Films, Arne Sucksdorff photographer).

50. Design more of the spliced-in questions type of films such as produced by Churchill Films, Inc., Los Angeles, California.

51. Produce media for teacher in-service training showing teachers interacting with students in the classroom when an unexpected, unusual response occurs. Show failure of teacher to capitalize on such a spontaneous situation with resulting closure and then show how the flexible and ingeneous teacher learns not to be surprised and uses such responses to advantage.

52. Develop media for teacher training showing teachers not capitalizing on classroom events or experiences that would foster creativity--how not to do it.

53. Develop a multitude of creative problem-solving types of visual aids.

54. Design media to show failures such as why inventions and discoveries did not work.

55. Design media around perplexing social problems with no solution.

56. Develop tapes with narration consisting only of ideas and instructions for listeners not to pre-judge but use these as springboards to generate more ideas on their own.

57. Use or produce media showing the development of ideas instead of products.

58. Develop media around intuitive, exploratory borders of knowledge (hunches) without confining or testing hypotheses.

59. Develop media depicting how great ideas or innovative people get into trouble.

60. Design media with a negative viewpoint showing most effective ways to stifle or hinder creativity.

61. Develop subtle, single-channel media such as pictures without narration, or audio tapes of drama and comedy (like the old silent movie) where the message is enjoyed through the audiences own imagination.

62. Design or use media for the sole purpose of teasing out ideas and which permit creative behaviors or responses to emerge by the student himself; such as asking the question what does this (color, sound, image, etc.) make you feel like?

63. Design or use media around a solution to a problem and then require students to think up different problems which this solution created.

64. Develop media around a case study approach to a problem and then pose the question: "What would you do?"

65. Design a media device to show the highly developed learning skills children have by the time they enter school and how teachers should build onto these.

66. Develop media for strengthening attitudes that a student should have toward prior information he possesses to show the importance of using such information to create.

67. Develop media showing idosyncracies of creative people living in the creative process way of life rather than in the conventional, traditional way.

68. A conceivable goal of education is learning how to change and adapt Develop media depicting change and adaptation in nature and parallel this phenomenon to human beings.

69. Develop a sound-motion picture or film strip designed around some of the most promising exercises for creative attack merely for the principle of warm-up for teachers use before going into a lesson; i.e., brick uses, similies, brainstorming, nine-dot problem, match problems, etc.

70. Develop media giving information about the creative process to be used by teachers solely to motivate and orient students before taking up a subject.

71. Design media (film) around respect and reward for unusual questions and ideas with ways that teachers can encourage and give opportunities for such behavior.

72. Develop or use media for providing enlightenment concerning the nature and psychology of creative thinking skills.

73. Design a medium for comparing or contrasting creative thinking in the areas of science, invention, or planning with the areas of music writing and the visual arts. The first area may be shown as problem-solving; the second as problems of expression in artistic form.

74. Develop an animated film or film strip for viewing the human being as a processor of information linking the creative process to information theory (Guilford General Problem-Solving Model); i.e., committing and coding information to storage and retrieval of information in some new form or connection other than that with which they were learned and stored.

75. Develop media (film) depicting unresolved social issues of our contemporary world requiring creative solutions.

76. Develop media for emphasizing the kinds of extended efforts which individuals need for invention, discovery, and creating.

77. Design media (film or series of films) which would present or extend the students range of emotional responses through effective dramatizations.

78. Develop media expressly for the purpose of identifying needs of people and communicate these needs with considerable impact by effective use of media.

79. Develop media around dramatic problem situations in history by which students could not only easily identify with historical personalities but also be personally committed to their problems. Such media should not include the actual course of action taken in history but instead require the student to use his own ingenuity in devising possible courses of action by their own analysis of the situation.

80. Use and develop media which pose questions neither the teacher nor the student can answer on authority yet to which there obviously must be some definitive answers.

81. Develop a media device for motivating students toward an exercise in using their imagination for sketching out the kinds of things a particular field or area of knowledge might be comprised of a decade, a half century, or a century from now.

82. Develop media around the objective of people and events adjusting man's environment as contrasted to those who adjust to the environment.

83. Design programmed materials purposely for the development of the creative behaviors of transformation and evaluation; i.e., imaginative interrelation with knowledge and decision-making functions.

84. Develop programmed materials which cause students to search for all possible definitions of a problem.

85. Design media for teacher training showing how a wide repertoire of functions performed by the teacher in the teaching act with varied opportunities for students to learn in different ways in a self contained classroom will enhance the students ability to learn.

86. Design media (film) comparing illustrative examples of people looking at information imaginatively by using it to see where it might take them rather than judging information to see what is wrong with it or where it has taken them.

87. Stop a film or programmed learning device at some crucial point and have the students themselves create and design continuing inputs or entry information in order to bring it to a completion.

88. As a class project, make a home-made 8mm. film around the life of some local person who is known to be highly creative.

89. Develop a silent film or film-strip in pantomine of the process of some creative accomplishment with blank sequences where viewers are given the opportunity to guess what is occurring.

90. Have students choose for themselves ways in which they want to use information presented after a film or TV program and allow them various opportunities in ways they want to work; e.g. committee, independent, combination groups, individual.

91. Develop a three-part sound-motion picture around some simple event or physical phenomenon which would lead students to ask questions about the event, guess things leading up to the event (causes), and guess things that might happen after the event (consequences).

92. Design a media device which identifies a problem and requires students to form their own hypotheses.

93. Develop an animated biographical story of an animal or insect showing how it has solved problems of existance, innovation, and survival. Use this as an approach to have young students transfer from the animal or insect example to that of man.

94. Show a film or film-strip based upon some scientific principal and have students think of all analogous uses the principal has.

95. Design a two-part film or video tape which would discuss with examples and contrast critical reading, listening, and viewing to creative reading, listening, and viewing. Use this as an introduction to a unit on critical vs. creative thinking.

96. Have film producers invite a team of creative curriculum directors and classroom teachers in for planning sessions when designing a new medium device.

97. Develop self-instructional programs based upon the concept of originality in which likely responses would be scored incorrect or penalized and unlikely responses accepted and rewarded.

98. Develop media around the concept of mystery such as presenting the principles of science so that students would be required to do detective work on the mysteries of nature.

99. Design film sequences showing a beginning and an outcome of an event and ask students to create the intervening steps of the event.

100. Show an event or sequence of events on film asking students to list all of the questions which occur to them as they view the film. Then have students suggest ways in which they can find out the answers to the questions listed. Finally have them test their suggested ways by seeing if they can answer the questions posed.

101. Develop career type media (films or film-strips) of creative people in the work world showing the kinds of factors that contribute to creative success on the job. Show what creative workers do and how they behave. Use these as models of creative work areas with which high school students can identify for career guidance.

102. Develop tape recordings of the creative process taking place in a classroom situation. Have students analyze the tape to reinforce their learning and realization of how the creative process developed and unfolded.

103. Develop and use a checklist when previewing and evaluating a visual aid based upon Torrance's twenty principles of creative thinking.

104. Develop media devices for parents so that child rearing practices for creativity can be stimulated in the home at a very early age.

105. Design media (film) depicting the principle of incubation showing how it has worked in many instances. Follow this up with any information type film and give directions that it will be discussed at some later date after students have had the opportunity to incubate.

106. Develop a series of "What I would have done" type films or film strips based upon problems in particular fields. Use problems which present difficult situations but which give no solution so that students do not become "set." Develop such films for teachers around controversial classroom situations and use as lead activities for teachers discussion groups.

107. Design media that would take children to the forefronts of scientific endeavors to give them the feeling of participation and stimulation in processes of innovation and adventure.

108. Use discarded film footage from commercial producers that would present raw information without answers available from which children could then hypothesize and draw their own conclusions.

109. Use media to present the mysteries of scientific phenomena.

110. Design a trunk film to present an overview of a subject which pose questions for mass viewing with shorter satellite films that define, clarify, or answer questions for individual use.

111. Design media (trunk films) around non-controversial issues of a subject with shorter satellite films which present the controversial issues out of which teachers can select those safe to use within her own community or setting.

112. Develop media which stimulate categorization behavior and allow opportunities solely for classifying information.

Research Areas

1. It is not known how best to program inputs--film mediated, teacher mediated, or combinations of both to develop creative behaviors.

2. It is not known if single channel inputs via some teacher mediated activities are more efficient for evoking creative behaviors than multi-channel inputs.

3. It is not known if the same programmer strategy (inputs) will evoke more than one class of creative behavior as an output. For example, an arrangement of inputs to evoke fluency may not be the same as that to evoke elaboration transformation or evaluative behaviors.

4. Are single-channel inputs better for allowing the viewer to roam in his own imagination than multi-channel inputs which too specifically compartmentalized the situation leaving him no alternatives within which to move?

5. Research is needed on the type and extent of instructions for film users (teachers) when film is used for developing creativity.

6. It is known that creative people prefer relatively complex visual stimuli. What is the relationship between preference for complex stimuli and ability to create after exposure to such stimuli via instructional media?

7. Is it necessary for the medium designer (programmer) to have a specific knowledge of the intended audience for which the AV device is to be used; (IQ-age-sex-developmental level) and if so how much and what kind of knowledge?

8. If instructional media posed different questioning techniques other than: who is? what is? how much is? when? and where? which all require convergent abilities and instead ask questions requiring divergent abilities such as: how to? how come? what if? and what other ways? would they more likely evoke creative answers?

9. Can media be used or designed to point out similarities as well as differences in presented information for developing creative behavior.

10. Since creative people are more perceptive are they more prone to become overloaded with multi-sensory perceptions causing them to become anxious, frustrated, and confused thereby hindering their creative potential?

11. Is the master creative teacher on television as effective an object of student's identification as the same teacher in the classroom or; is the master teacher on television teaching creatively as effective as the regular classroom teacher who is creative?

12. What are the optimum ways of presenting information via media devices for highly gifted children (intelligent and creative) as compared to less gifted children?; or. . .as compared to culturally and socially deprived children?

13. Are media materials that get students involved in the creative process presented in a simple, straight forward manner better able to develop creativity than those which are highly embellished with various attention-getting and arousal techniques?

14. Can creativity be better developed by media devices that present unsolved problems about a subject before or after presenting a solved problem in the subject? Research on timing and task-induced set is needed.

15. Can imagination and originality as creative factors be better developed by single-channel inputs, multi-channel inputs or combinations of channels to accomodate channel switching in the human mind (listening, reading vs. listening and seeing simultaneously vs. all combinations)?

16. What is the optimum range for speed of presentation of various sensory inputs via audiovisual media for developing creative behaviors?

17. What type of inputs and follow-up techniques are needed to stimulate creativity after a film, TV program, or radio broadcast in order for students to pick up where the device left off?

18. Research is needed on the effects of directions before, during, or after using instructional media for fostering creative behaviors i.e., cues, instructions, examples, practice.

19. What types of feedback, knowledge of results, and reinforcement are most conducive for creativity out of the use of instructional media?

20. Research is needed on the most effective agent for giving feedback, knowledge of results or reinforcement, the teacher, the device, fellow students?

21. Is there a basic structure of existing media that "programs" or inhibits creativity?

22. What type and kinds of auto-instructional materials facilitate creative thinking?

23. Can modifications in the use or design of mass media programs covering specified subject-matter content (physics films series, etc.) be made to permit their use for developing creative thinking while at the same time mastering subject-matter?

24. How can a well designed instructional media device with some built-in creativity developmental techniques be used for teacher in-service training to produce an effect on the classroom behavior of teachers?

25. Will a saturation of relevant inputs presented via multi-channels simultaneously followed by instructions for the viewer to strive for new creative combinations out of this saturation produce creative behaviors?

26. How can media be designed or used to permit the viewer to toy and play with information as it is presented so as to react to it creatively?

27. How can media be designed or used to permit an open system which encourages multiple approaches and divergent thinking about information being transmitted?

28. How can media be used to encourage broadly diffused instead of narrowly focused attention to transmitted information via instructional media for imaginative, original thinking?

29. Would the use of electronic media devices interfere with or blot out any creativity effects that the teacher herself has been able to develop?

30. Experiments are needed with new ways for making books more effective for evoking creative behaviors; i.e., ways to involve the reader, ways to encourage the reader to question what is read rather than accept the information, etc.

31. Research support is needed for designing various samples covering the same information of school textbooks and experimenting with their individual effectiveness for deliberately developing creativity along with presenting subject-matter content.

32. Research is needed for ways in confronting the learner with situations via different media in which creative behaviors are actually practical rather than covertly or passively experienced.

33. How can teaching materials (media) be constructed so that they may both orient the student to a clearly defined goal as well as energize the student to work toward this goal on his own initiative toward a self- generated solution?

34. Assuming teachers, not media, produce creative learning experiences the question to be answered is if teachers can be sensitized via media to teach creatively; and if so what kind of media?

35. How can information be provided via various media so that students may probe the nature of problem areas and as a consequence of such trial activity obtain feedback for further self-initiated problem solving activity on the part of the student?

36. Does student interaction with media materials produce learning skills relevant to established academic school curricula?

37. How can pictorial style and use of words in the narration of programmed materials give a feeling of an open ended interpretation rather than finality to a problem?

38. Using the book as a medium, how can the teacher interact with the student in developing the mental processes of making new associations, transformations, and implications from the presented information?

Film References

College Teaching with Television: An Inter-Institutional Approach, Produced by Lester F. Beck. U. S. Office of Education, Media Research and Dissemination Branch, Washington, D. C.

Early Marriage, Produced by Lester F. Beck. E. C. Brown Trust, 3170 S.W. 87th Street, Portland, Oregon.

Electrochemical Cells, CHEM Study Project, University of California, Berkeley, California

On Darwin's Trail (Aug den Spuren Darwins). Institute für Film and Bild, Deutsche Museum, Munich, Germany.

Squeak the Squirrel (with trailer). Produced by Lester F. Beck, Churchill Films, 662 North Robertson, Los Angeles, California.

REFERENCES

Allport, G. W., Vernon, P. E., and Lindzey, G. Study of values (Rev. Ed.): Manual of directions. Boston: Houghton Mifflin, 1951.

Anderson, D. N. An experimental evaluation of two methods of developing creative problem-solving abilities in an industrial arts course. Doctoral dissertation, Univer. of Minnesota, Minneapolis, Minn., 1963.

Andrews, Elizabeth G. The development of imagination in the pre-school child. University of Iowa studies of character, 1930, 3 (4).

Andrews, M. F. (Ed.). Creativity and psychological health. Syracuse: Syracuse University Press, 1961.

Barkan, M. Transition in art education. Art Education, 1962, 15, 12-18, 27.

Barron, F. Originality in relation to personality and intellect. J. Person., 1957, 23, 730-742.

Barron, F. Creativity and psychological health. Princeton, N. J.: D. Van Nostrand Co., Inc., 1963.

Beittel, K. R. Predictors and settings relating to the capacity for creative action in the visual arts. A progress report and data summary of studies analyzed or begun since January, 1961, supported by National Science Foundation GL-17984. January, 1962, 88. (Multilithed).

Beittel, K. R. Factor analyses of three dimensions of the art judgment complex: criteria, art objects, and judges. J. Exper. Educ., 1963, 33, (2), 167-174.

Beittel, K. R. Creativity in the visual arts in higher education: criteria, predictors, experimentation, and their interaction. In C. W. Taylor (Ed.) Widening horizons in creativity. New York: Wiley, 1964.

Beittel, K. R. Curriculum experimentation in art education as seen through recent research. In P. C. Rosenbloom (Ed.) Modern viewpoints in the curriculum. New York: McGraw-Hill, 1964, 113-128.

Beittel, K. R. On the relationships between art and general creativity: a biased history and projection of a partial conquest. School Review, 1964.

Beittel, K. R. and Burkhart, R. C. Effect of self-reflective training in art on the capacity for creative action. Project No. 1874, U. S. Office of Education Cooperative Research Program, October 1962 to December 1964.

Beittel, K. R. and Burkhart, R. C. Strategies of spontaneous, divergent, and academic art students. Studies in art education, 1963, 5 (1), 20-41.

Bernheim, Gloria D. The dimensionality of differential criteria in the visual art product. Studies in art education, 1964.

Binet, A. Les idées modernes sur les enfants. Paris, France: E. Flamarion, 1909.

Bloom, B. S. Some effects of cultural, social, and educational conditions on creativity. In C. W. Taylor (Ed) The second (1957) University of Utah research conference on the identification of creative scientific talent, 1958, 55-65.

Bois, S. J. Explorations in awareness. New York: Harper & Row, 1957.

Brilhart, J. K., and Jochem, Lurene, M. Effects of different patterns on outcomes of problem-solving discussion. J. appl. Psychol., 1964, 3, 175-179.

Brunelle, E. A. Problem solving: intelligence and creativity. Unpublished paper, Orange State College, Fullerton, Calif., 1964.

Bruner, J. S. The process of education. Cambridge: Harvard Univer. Press, 1960.

Bruner, J. S. On knowing. Cambridge: Harvard University Press, 1962.

Burkhart, R. C. The creativity-personality continuum based on spontaneity and deliberateness in art. Studies in art Education, 1960, 2 (I), 43-65.

Burkhart, R. C. Progress in art as self-reflective learning for the student. *Western Arts Bulletin*, 1962.

Burkhart, R. C. *Spontaneous and deliberate ways of learning.* Scranton, Pennsylvania: International Textbook Co., 1962.

Burkhart, R. C. Depth's four dimensions. *School arts*, 1963, 30-31.

Burkhart, R. C. and Bernheim, Gloria. *Object question test manual.* University Park, Pa.: Dept. of Art Education, Pennsylvania State Univer., 1963.

Cattell, R. B. The personality and motivation of the researcher from measurements of contemporaries and from biography. In C. W. Taylor (Ed.) *The third (1959) University of Utah research conference on the identification of creative scientific talent*, 1959, 77-93.

Clements, R. D. Question types, patterns, and sequences used by art teachers in the classroom. Cooperative Research Project No. S-161, The Pennsylvania State Univer, July-December, 1964.

Colvin, S. S. and I. F. Meyer. Imaginative elements in the written work of school children. *Pedagogical Seminary*, 1906, 13, 84-93.

Conant, J. B. *The education of American teachers.* New York: McGraw-Hill, 1963.

Crane, E. V. *The administrative orientation of self.* Massachusetts: Christopher Publishing House (circa 1960).

Crawford, R. P. *The techniques of creative thinking.* New York: Hawthorn Books, 1954.

Crutchfield, R. S., and Covington, M. V. Facilitation of creative thinking and problem solving in school children. A paper presented at the A.A.A.S. Convention, Cleveland, Ohio, 1963.

Cunnington, B. F., Pearl Buckland, and R. Peterson. *Giovanni and the Giant.* Minneapolis: Bureau of Educational Research, Univer. of Minnesota, 1962.

Cunnington, B. F., R. E. Myers, Pearl Buckland, and R. G. Peterson, *Eyes at their fingertips.* Minneapolis: Bureau of Educational Research, 1962.

Cunnington, B. F., R. G. Peterson, Pearl Buckland and R. E. Myers. *All-around American.* Minneapolis: Bureau of Educational Research, Univer. of Minnesota, 1963.

De Simone, D. V. Community programs of assistance to inventors and innovators. Memorandum, U. S. Department of Commerce, Inventions and Innovations Division, Washington, D. C., 1963.

Dewey, J. How we think. Boston: Heath, 1910.

Duncker, K. On problem solving. Psychol. Monogr., 58 No. 5, 1945.

Durrell, D. D., and J. R. Chambers. Research in thinking abilities related to reading. Reading teacher, 1958, 12, 89-91.

Ely, D. P. (Ed.) The changing role of the audiovisual process in education: a definition and a glossary of related terms. Technological development Project Monograph No. 1. Los Angeles: School of Education, Univer. of Southern California, 1963. (Also published in AV Communication Review, Supplement 6, 11: 1-148; January-February 1963.) (USOE Title VII Project No. B-069; Univer. Microfilms Pub. No. 64-744.)

Enochs, P. D. An experimental study of a method for developing creative thinking in the fifth grade. Doctoral dissertation, University of Missouri, Columbia, Mo., 1964.

Finn, J. D. Automation and education: I. general aspects, Audio-visual communication review 5:1, 343-60, 1957.

Finn, J. D. Automation and education: II. Automatizing the classroom-background of the effort, Audio-visual communication review 5:2, 451-67,, 1957.

Finn, J. D. Automation and education: III. Technology and the instruction process, Audio-visual communication review 8:1, 5-26, 1960.

Finn, J. D. A walk on the altered side. Phi Delta Kappan, Vol. XLIV. Number 1, 29-34, 1962.

Finn, J. D., Perrin, D. G., and Campion, L. F. Studies in the growth of instructional technology, I: audio-visual instrumentation for instruction in public schools, 1930-1960; a basis for take-off. Technological development project occasional paper No. 6. Los Angeles: Univer. of Southern California August 1962, 108. (USOE Title VII Project No. B-069; Univer. Microfilms Pub. No. 64-747) Abstracted in Audio-visual communication review, 1963, 11 (5) A-153.

Forehand, G. A. and Libby, W. L., Jr. Effects of educational program and perceived organizational climate upon changes in innovative administrative behavior. In Innovative behavior. Cooperative Research Project No. 975. Chicago: Univer. of Chicago, Center for Programs in Governmental Administration, 1962.

Freud, S. The basic writings of Sigmund Freud. (Edited by A. A. Brill) New York: Random House, 1938.

Gordon, W. J. J. Synectics: the development of creative capacity. New York: Harper and Row, 1961.

Gotkin, L. G., and N. Massa. *Programmed instruction and the academically gifted: the effects of creativity and teacher behavior on programmed instruction with younger learners.* New York: The Center for Programmed Instruction, 1963.

Gough, H. G., and Heilbrun, A. B., Jr. *The adjective check-list manual.* Palo Alto, Calif.: Consulting Psychologists Press, 1965.

Grover, B. L. Some effects and correlates of different types of practice used in studying a topic in ninth grade classrooms. Doctoral dissertation, University of Minnesota, Minneapolis, Minn., 1963.

Guilford, J. P. Three faces of intellect. *Amer. Psychologist*, 1959, 14, 469-479.

Guilford, J. P. Creative thinking and problem solving. *Educ. Digest*, 1964, 29, 29-31.

Guilford, J. P. Some new views of creativity. In H. Helson (Ed.) *Theories and data in psychology.* Princeton, N. J.: D. Van Nostrand Co., 1965.

Haefele, J. W. *Creativity and innovation.* New York: Reinhold, 1962.

Holland, J. L. Some limitations of teacher ratings as predictors of creativity. *J. educ. Psychol.*, 1959, 50, 219-222.

Holland, J. L. The assessment and prediction of creative performance of high aptitude youth. A paper presented at The fifth (1962) *University of Utah research conference on the identification of creative scientific talent.* Salt Lake City: 1962.

Holland, J. L., and Astin, A. W. The prediction of academic, artistic, scientific and social achievement among undergraduates of superior scholastic aptitude. Evanston, Ill.: National Merit Scholarship Corporation, 1961. (Unpublished manuscript).

Hudson, L. Personality and scientific aptitude. *Nature*, 1963, 198 (4883), 913-914. (ALso see *Nature*, 196, 601, 1962.)

Hutchinson, W. L. Creative and productive thinking in the classroom. Doctoral dissertation, Univer. of Utah, S. L. C., Utah, 1963.

Hutchinson, W. L. Creative and productive thinking in the classroom". *J. of Rocky Mtn. Psychological Assoc.*, 1964, 20-29.

Hyman, R. On prior information and creativity. *Psychological Reports*, 1961, 9, 151-161.

Hyman, R. Creativity and the prepared mind: the role of information and induced attitudes. A paper presented at *The fifth (1962) University of Utah conference on the identification of creative scientific talent.* Salt Lake City, 1962.

Hyman, R. Creativity and the prepared mind: preconceptions in creative achievement and in creativity research. Paper presented at National Art Education Association Conference, Kansas City, Missouri, March 13, 1963.

Inhelder, B., and Piaget, J. *The growth of logical thinking from childhood to adolescence.* New York: Basic Books, 1958.

Inhelder, B. and Piaget, J. *The early growth of logic in the child.* New York: Harper and Row, 1964.

Jex, F. B. Negative validities for two different ingenuity tests as criteria for judging the effectiveness of the ingenuity test. In C. W. Taylor (Ed.) *The third (1959) University of Utah research conference on the identification of creative scientific talent,* 1959, 124-127.

Johnson, P. T. The growth of the creative thinking abilities in Western Samoa. Doctoral dissertation, Univer. of Minnesota, Minneapolis, Minnesota, 1963.

Jones, F. E. RPI human factors study of creativity. Multiple correlation based on factors of aptitude. Unpublished paper, Troy, N. Y.: Rensselaer Polytechnic Institute, 1964.

Jones, L. H., Jr. The relationship of patterns of time usage to creative behavior in art. Unpublished D. Ed. thesis, The Pennsylvania State University, 1964, 123.

Jones, L. H., Jr. Student and teacher interaction during evaluative dialogues in art. Cooperative Research Project No. S-050, The Pennsylvania State University, 1964.

Kirkpatrick, E. A. Individual tests of school children. *Psychological Review,* 1900 5 (7), 274.

Köhler, W. *The mentality of apes.* New York: Harcourt, Brace, 1925.

McConnell, T. R. Discovery vs. authoritative identification in the learning of children. *University of Iowa studies in education,* 1934, 9 (5), 13-62.

MacKinnon, D. W. Characteristics of the creative person. Implications for the teaching-learning process. In *Current issues in higher education.* Washington, D. C.: Association for higher education, 1961, 89-92.

MacKinnon, D. W. The nature and nurture of creative talent. *Amer. Psychol.*, 1962, *17*.

MacKinnon, D. W. The study of creativity. Proceedings of conference on *The creative person.* Berkeley: Univer. of California Press, 1962.

MacKinnon, D. W. (Ed.). The creative person. Berkeley, Calif.: Univer. of California General Extension, 1962.

McLuhan, M. Understanding media. New York: McGraw-Hill Book Co., 1964.

McNeill, Mary. Hail stones and halibut bones, Garden City: Doubleday, 1961.

Maier, N. R. F. Reasoning in humans. The solution of a problem and its appearance in consciousness. J. comp. physiol. Psychol., 1931, 11, 181-194.

Maltzman, I. On the training of originality. Psychological Rev., 1960, 67, 229-242.

Maslow, A. H. Emotional blocks to creativity. A lecture before Creative Engineering Seminars. Fort Belvoir, Virginia: U. S. Army Engineers, 1958.

Maslow, A. H. Creativity in self-actualizing people. In H. H. Anderson (Ed.) Creativity and its cultivation. New York: Harper, 1959.

Mattil, E. L., Burkhart, R. C., and Beittel, K. R. The effect of a 'depth' vs. a 'bredth' method of art instruction at the ninth grade level. Studies in art education, 1961, 3 (1), 75-87.

Mattil, E. L., et al. A seminar in art education for research and curriculum development. Proposal to the U. S. Office of Education, Developmental Activities Program, 1964.

Mearns, H. Creative power. New York: Dover Publications, 1958.

Miel, Alice (Ed.). Creativity in teaching. Belmont, Calif.: Wadsworth, 1961.

Mooney, R. Problems in the development of research men. Educational Research Bulletin, XXX (September 1951), 141-150.

Mooney, R. Lecture-demonstration on perception as a transaction. Columbus, Ohio: Bureau of Educational Research and Service, The Ohio State Univer, 1951, 21pp.(Lithoprinted).

Mooney, R. A study of perception as a guide to a study of leadership. Columbus, Ohio: Bureau of Educational Research and Service, The Ohio State University, 1951, 26pp. (Mimeographed).

Mooney, R. Classification of items in a 'preliminary listing of indices of creative behavior'. Columbus, Ohio: Bureau of Educational Res. and Services. The Ohio State Univer., 1953, 10 pp. (Mimeographed)

Mooney, R. Groundwork for creative research. The American Psychologist, 9 (9) (September, 1954, 544-548.

Mooney, R. Evaluating graduate education. The Harvard educational review, XXV, 1955, 85-94.

Mooney, R. The artist and our human need. J. of human Relations, 1955, 9-16.

Mooney, R. Cultural blocks and creative possibilities. Educational Leadership, 1956, 13, 5, 273-278.

Mooney, R. Perception and creation. Columbus, Ohio: Bureau of Educational Research and Service, The Ohio State University, 1956, 21 pp. (Mimeographed).

Mooney R. On meeting cultural blocks to creativity in the army engineer research and development laboratories. Columbus, Ohio: The Bureau of Educational Research and Service, The Ohio State Univer., 1957, 30 pp. (Mimeographed).

Mooney, R. The researcher himself. Research for curriculum development Washington, D. C.: Assoc. for Supervision and Curriculum Development 1957, 154-186.

Mooney, R. Creation and counseling. Columbus, Ohio: Bureau of Educational Research and Service, The Ohio State University, 1960, 34 pp. (Mimeographed).

Mooney, R. Creation and communication. Creativity and psychological health, Michael L. Andrews (Ed.) Syracuse, N.Y.: Syracuse Univer. Press, 1961, 38-41.

Mooney, R. A conceptual model for integrating four approaches to the identification of creative talent. In C. W. Taylor and F. Barron (Eds.) Scientific creativity: its recognition and development. New York: Wiley, 1963, 331-340.

Mooney, R. The problem of leadership in the university. Educational research: new perspectives. Jack A. Culbertson and Stephen P. Hencley (eds.), Danville, Illinois: The Interstate Printers and Publishers, 1963, 31-48.

Mooney, R. Training for research in educational administration, In J. A. Culbertson and S. P. Hencley (Eds.) Educational research: new perspectives, Danville, Ill.: The Interstate Printers and Publishers, 1963, 325-340.

Mooney, R. Creation and teaching. In W. P. Street (Ed.) Creativity and college teaching. Bulletin of the Bureau of School Service, 1963, 25 (4) 45-62. College of Education, Univer. of Kentucky, Lexington, Ky.

Mooney, R. By way of tragedy. Columbus, Ohio: Bureau of Educational Research and Service, The Ohio State University, 1963, 13. (Mimeographed).

Mooney, R. Logos in its present state. Columbus, Ohio: Bureau of Educational Research and Service, The Ohio State University, 1963, 7 (Mimeographed).

Mooney, R. Logos in creation. Columbus, Ohio: Bureau of Educational Research and Service, The Ohio State University, 1963, 12 (Mimeographed).

Mooney, R. Nurturing the educational researcher as a creative artist. Columbus, Ohio: Bureau of Educational Research and Service, The Ohio State University, 1964, 58 (Lithographed).

Munari, B. Who's there? Open the door. New York: World Publishing Co., 1957.

Munari, B. The elephant's wish. New York: World Publishing Co., 1959a.

Munari, B. The birthday present. New York: World Publishing Co., 1959b.

Myers, G. C. Gallant and Goofus. Highlights for children, 1964.

Myers, R. E. and E. P. Torrance. Invitations to thinking and doing. (Ideabook of exercises and teachers guide). Minneapolis: Perceptive Publishing Co., 1961.

Myers, R. E. and E. P. Torrance. Invitations to speaking and writing creatively. (Ideabook of exercises and teachers guide) Minnneapolis: Perceptive Publishing Co., 1962.

Myers, R. E. and E. P. Torrance. Can you imagine? Minneapolis: Perceptive Publishing Co., 1963.

Myers, R. E. and E. P. Torrance. For those who wonder. Eugene, Oregon: Perceptive Publishing Co., 1964.

Ojemann, R. H. Research in planned learning programs and the science of behavior. J. of educ. Res., 1948, 42, 96-104.

Ojemann, R. H. and Karen Pritchett. Piaget and the role of guided experiences in human development. Perceptual and motor skills, 1963, 17, 927-939.

Osborn, A. F. Applied imagination. New York: Scribners, 1963.

OSS Assessment Staff. Assessment of men. New York: Rinehart, 1948.

Provus, M. Teaching critical thinking through history. School Rev., 1955, 63, 393-6.

Provus, M. It's all in the way you look at it. Instructor magazine, 1959, 68, 23.

Provus, M. All the way home. Learning Materials, Inc., 1961, 16, Chicago, Illinois.

Provus, M. Study in creative problem solving, Board of Education, Chicago Public Schools, 1962.

Parnes, S. J. The deferment-of-judgment principle: a clarification of the literature. Psychological Reports, 1963, 12, 521-522.

Parnes, S. J., and Harding H. F. (Eds.) A source book for creative thinking. New York: Scribners, 1962.

Piaget, J. Logic and psychology. Manchester: Manchester University Press, 1953.

Rank, O. Will therapy and truth and reality. New York: Knopf, 1945.

Rogers, C. In Farber, S. M., et al., (Ed.) Conflict and creativity. New York: McGraw-Hill, 1963.

Rogers, C. Toward a theory of creativity. ETC: A review of general semantics, 1954, 11(4), 249-260.

Rossman, J. The psychology of the inventor. Washington, D. C.: Inventors Publishing Co., 1931.

Rugg, H. Imagination. New York: Harper and Row, 1963.

Schmadel, Elnora. The relationship of creative thinking abilities to school achievement. Unpublished doctoral dissertation. Los Angeles: Univer. of Southern California, 1960.

Schwartz, B. The effect of working time and instruction in art upon the process characteristics and aesthetic quality of art performance. Ed.D. thesis, The Pennsylvania State University, 1964.

Selye, H. The stress of life. New York: McGraw-Hill, 1956.

Selye, H. From dream to discovery. New York: McGraw-Hill, 1964.

Simpson, R. M. Creative imagination. American J. of Psychology, 1922, 234-243.

Smith, P. (Ed.) Creativity. New York: Hastings House, 1959.

PRECEDING PAGE MISSING

Sommers, W. S. The influence of selected teaching methods on the development of creative thinking. Doctoral dissertation, Univer. of Minnesota, Minneapolis, Minnesota, 1961.

Standing, E. M. Maria Montessori - her life and work. New York: New American Library of World Literature, 1962.

Stein, M. I., and Shirley J. Heinze. Creativity and the individual. New York: Free Press of Glencoe, 1960.

Taylor, C. W. (Ed.) The 1955 University of Utah research conference on the identification of creative scientific talent. Salt Lake City: Univer. of Utah Press, 1956.

Taylor, C. W. (Ed.) The 1957 University of Utah research conference on the identification of creative scientific talent. Salt Lake City: Univer. of Utah Press, 1958.

Taylor, C. W. (Ed.) The 1959 University of Utah research conference on the identification of creative scientific talent. Salt Lake City: Univer. of Utah Press, 1959b.

Taylor, C. W. The creative individual: a new portrait in giftedness. Educ. Leadership, 1960, 18 (1), 7-12.

Taylor, C. W. Research findings on creative characteristics. Studies in art education, 1961, 3, 9-17.

Taylor, C. W. A tentative description of the creative individual. In W. B. Waetjen (Ed.) Human variability and learning. Washington, D. C.: Assoc. for Supervision, and Curriculum Development, 1961e, 62-79. Also appears as Chapter 15 in A source book for creative thinking, Parnes, S. J., and Harding, H. F. (Eds.) New York City: Charles Scribner's Sons, 1962, 169-184.

Taylor, C. W. Effects of instructional media on creativity: a look at possible positive and negative effects. Educ. Leadership, 1962b, 19 (7), 453-458.

Taylor, C. W. Some educational implications of creativity research findings. School science and mathematics, 1962, 62 (8) 593-606.

Taylor, C. W. Who are the exceptionally creative? Exceptional Children, April 1962e, 28 (8), 421-431.

Taylor, C. W. Are we utilizing our creative potential? Nursing Outlook, 1963 11 (2), 105-107.

Taylor, C. W. Clues to creative teaching. Series of ten articles appearing in The Instructor Magazine, Sept., 1963 to June, 1964, Dansville, New York.

Taylor, C. W. (Ed.) *Creativity: progress and potential.* New York: McGraw-Hill, 1964.

Taylor, C. W. (Ed.) *Widening horizons in creativity.* New York: Wiley, 1964.

Taylor, C. W., and Barron F. (Eds.) *Scientific creativity: its recognition and development.* New York: Wiley, 1963, pp. 407.

Taylor, C. W., Smith, W. R., Ghiselin, B., and Ellison, R. L. Explorations in the measurement and prediction of contributions of one sample of scientists. Report ASD-TR-61-69, Aeronautical Systems Division, Personnel Laboratory, Lackland Air Force Base, Texas, April, 1961.

Taylor, C. W., Ghiselin, B. and Wolfer, J. Bridging the gap between basic research and educational practice. *Nat'l. educ. assoc. J.*, 1962, *51*, 23-25.

Taylor, C. W., Ghiselin, B., Wolfer, J., Loy, Lorraine, and Bourne, L. A theory of education based upon psychological and other relevant research findings. Unpublished manuscript, Univer. of Utah, 1963.

Taylor, C. W., and Holland, J. Predictors of creative performance: a status report of the present research knowledge and some implications for research 1962 (mimeographed).

Taylor, C. W., Ellison, R. L. and Tucker, M. F. Biographical information and the prediction of multiple criteria of success in science. Supported by, the National Aeronautics and Space Administration, Research Project NASw-105, 1965.

Taylor, D. W., Berry, P. C., and Block, C. H. Does group participation when using brainstorming facilitate or inhibit creative thinking. Technical report I, Nonr 209(20) (Nr 150-166) for Office of Naval Research, 1957.

Terman, L. M. *Concept mastery test, manual, Form T.* New York: The Psychological Corporation, 1956.

Thompson, Laura. *Toward a science of mankind.* New York: McGraw-Hill 1961, 276 pp.

Thurstone, L. L. Creative talent. In *Proceedings of the international conference on testing problems.* Princeton, N. J.: Educational Testing Service, 1950.

Torrance, E. P. Conditions for creative growth. Minneapolis: Bureau of Educational Research, Univer. of Minnesota, 1960. (Mimeographed).

Torrance, E. P. *Guiding creative talent.* Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1962.

Torrance, E. P. *Education and the creative potential.* Minneapolis: University of Minnesota Press, 1963

Torrance, E. P. Explorations in creative thinking in the early school years: a progress report. In C. W. Taylor and F. Barron (Ed.) *Scientific creativity: its recognition and development.* New York: Wiley, 1963.

Torrance, E. P. Creativity in the classroom: respecting children's questions and ideas. *The Instructor*, September 1964, pp. 37, 129.

Torrance, E. P. *Rewarding creative behavior.* Englewood Cliffs, N. J.: Prentice Hall, Inc., 1965.

Torrance, E. P. and B. F. Cunnington. *Sounds and images.* Minneapolis: Bureau of Educational Research, Univer. of Minnesota, 1962.

Torrance, E. P. and Harmon, J. A. Effects of memory, evaluative, and creative reading sets on test performance. *J. educ. Psychol.*, 1961, 4, 207-217.

Torrance, E. P. and R. E. Myers. *Teaching gifted elementary pupils how to do research.* Eugene, Oregon: Perceptive Publishing Co., 1962.

Torrance, E. P. and R. E. Myers. Teaching gifted elementary pupils research concepts and skills. *Gifted child quarterly*, 1962, *6*, 1-16.

Torrance, E. P. and R. Gupta. *Development and evaluation of recorded programmed experiences in creative thinking in the fourth grade.* Minneapolis: Bureau of Educational Research, Univer. of Minn., 1964.

Torrance E. P. and Staff. *Role of evaluation in creative thinking.* (Cooperative Research Project No. 725) Minneapolis: Bureau of Educational Research, Univer. of Minnesota, 1965.

Wallas, G. *The art of thought.* London: C. A. Watts, 1945.

Westcott, M. R. and Ranzoni, J. H. Correlates of intuitive thinking. *Psychol. Rep.*, 1963, 12, 595-613.

Whitehead, A. N. *The aims of education.* New York: Mentor Books, 1929.

Whipple, G. M. *Manual of mental and physical tests. Part II. Complex processes.* Baltimore, Md.: Warwick and York, 1915.

Will, Patricia Phinney. A study of the effects of possible emotional disturbance on the creative behavior of a group of delinquent girls. Master's research project, Univer. of Minnesota, Minneapolis, Minn., 1964.

Williams, F. E. An examination of progress upon the study of creativity. A paper presented at the Second Annual Conference of Higher Education of the California Teacher's Association. Burlingame, California: May, 1963.

Wilt, Miriam E. Creativity in the elementary school. New York: Appleton-Century-Crofts, 1959.

Upton, A. and Samson, R. W. Creative analysis. New York: E. P. Dutton, 1963.

Zirbes, Laura. Spurs to creative thinking. New York: G. P. Putnam's Sons, 1959.